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THE CHOICE OF MEDICINE AS A PROFESSION[1]

ONE of the most difficult and important questions for the college student to decide is the question: "What occupation shall I choose when I graduate from college?" It is a question, moreover, which every student ought to decide for himself. Every person's occupation should be suited to his tastes and capabilities and no one can decide whether a given occupation is suited to an individual's tastes and capacities so well as the individual himself. It makes no difference who the student is or what he is; if he is the millionaire's son and foolishly believes he need pursue no occupation at all, or if he is the merchant's son and is destined to fall into some niche prepared for him by parental industry, the truth still remains that if he is to enjoy the best gifts of life he must have occupation and that the occupation chosen should be one in which he can labor happily and usefully. Every student here present should study this question with the conviction that it is in many respects the most important and vital question of his life.

You are all to be congratulated upon the opportunity which is offered you for securing a college education. Whatever you eventually do, whatever occupation you elect to pursue, this college education will stand you in good stead, the higher its value the more wisely you avail yourselves of the opportunity it offers. It is somewhat the fashion nowadays to carp at the so-called liberal education and it is cer-

[1] Lecture delivered November 2, 1909, to the students of Tufts College.

tainly true that it does not accomplish all we have expected of it, a question we can not consider at the present time. Many persons have attempted to say what this same liberal education ought to consist of. In my opinion we may seek far and yet find no better definition than that given by Huxley. He said:

> That man, I think, has had a liberal education who has been so trained in youth that his body is the ready servant of his will, and does with ease and pleasure all the work that, as a mechanism, it is capable of; whose intellect is a cold clear logic engine, with all its parts of equal strength and in smooth working order; ready like a steam engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of nature and the laws of her operations; one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of nature or of art, to hate all vileness, and to respect others as himself.

Such an education as this Tufts College will give you if you do your part; such an education as this will prepare you for any vocation and, better still, will furnish you with the general knowledge which will enable you to select your eventual occupation understandingly. But remember too, as Gibbons says, that: "Every one has two educations, one which he receives from others and one, more important, which he gives himself." Do not neglect this self-education.

The earlier in your college course you are enabled to choose your profession, the better it will be for you, because early decision will enable you to choose your elective studies in such a manner as to bear directly upon your professional work. Mr. Flexner in an article in SCIENCE has said that "statistics roughly compiled seem to indicate that perhaps seventy-five per cent. of the members of the first-year law classes at Columbia and Harvard knew while in college that they would study law afterwards," and this would certainly indicate that an earnest student should be able to make his decision early enough to take advantage of the college offerings. Unfortunately it is the case that many college men form false ideals of what the professions really are. They idealize them from too narrow a view point, and slowly learning that they are different in a practical way from the conceptions they have formed, they become dissatisfied with them. They become, as it were, the round pegs in the square holes. They do not fit. They have chosen professions for which they are unsuited. This idealization of the profession is especially true of those contemplating the study of medicine. If we could look into the different aspirants' minds and see depicted there the different ideals that each one had formed, I am sure we should find a strange and incongruous society of physicians!

But, on the other hand, we should find that all had idealized certain qualities, though in different proportions. One man sees himself as the noted surgeon dashing about the country in his high-power motor, performing miraculous operations with curiously shaped instruments, and reaping a huge harvest of professional fees. Another sees himself the fashionable consultant, the Doctor Firmin, concerning whom Thackeray has told us so much, without whose approval and advice no one who is any one (at least so far as his bank account is concerned), can pass conventionally to the grave. Another pictures himself as the man of science working in his laboratory and discovering the cure of cancer, which shall make him for all time a benefactor of the human race; or he sees himself the special-

ist who knows everything which is known in some small branch of medical knowledge, and who is bending his best endeavors to searching out those secrets of his specialty which are as yet unknown. Or he sees himself as the teacher who is helping others to prepare themselves for the medical profession; or as the army surgeon whose medical knowledge is making possible some vast engineering achievement like the Panama Canal; or the surgeon on the side lines who dashes out to render first aid to the injured gladiator of the football arena, or as the medical expert, clashing swords with the cross-examining attorney in the heated atmosphere of the brain-storm. Or lastly he sees himself as the old-fashioned country doctor, passing his life among the tranquil beauties of nature, and driving in his battered buggy from village to village and from farmhouse to farmhouse, succoring the wounded, tending the sick; alleviating their pain and directing their treatment, a veritable good samaritan doing his best for the good of his fellows; making a sufficient livelihood for his simple wants and happy in the position he has made for himself, a respected councillor and loved friend,

Such are the various aspects in which the physician ordinarily appears to the average lay mind; as the surgeon, the consultant, the specialist, the expert, the official, the teacher, the hygienist and the general practitioner or family physician—or as one combining any or all these functions in varying degree. And such to a certain extent the average physician really is and the diversity of his functions is one of the great attractions of the profession. Ideals of such types blended together represent what the medical profession really is, but by far the preponderating type is the type of the old-fashioned country doctor, the general practitioner whether he be in country or in town.

By far the larger part of the regular medical profession of to-day is the family physician, who pursues medicine for the love he has for it and for the love he bears his fellows. And I say this confidently, knowing them as I do, and speaking concerning them and not as one of them. But I believe it would be hard to make them confess it of themselves, for the twentieth-century physician does not wear his heart upon his sleeve. He is half ashamed of his altruistic tendencies and often tries to hide them under a cloak of simulated roughness. He labors without pay in the hospitals and the slums; he forgets the weariness of his body and the pleasure of its indulgence in his delight in his calling; he is charitable to the poor; considerate of the moderately-well-to-do; he is a friend to those in affliction and is always ready to assume their burdens. If his work is arduous and the rewards are small, if his patients are exacting and his worries are great, he is always buoyed up by the consolation of the scientific interest of his work and by the knowledge of its usefulness. He is to-day a worthy exponent of the highest and noblest of all the professions, "the flower of our civilization," as Robert Louis Stevenson has said, and his duties are often of such a nature as to enable him to touch the heroic.

An incident of this latter nature, relatively so common in medical practise as scarcely to excite comment among physicians, was related to me the other day by a spectator, because of its humorous aspect. The patient, a child, was dying of blood poisoning and it was hoped that by the transfusion of blood from a healthy living person by the new Crile method, its life might be saved. Several members of our pathological department offered their

blood for this purpose and one of them was chosen. Let me remark, in passing, that he had never before seen the child nor its parents. An incision two or three inches long was made in his arm, deep enough to expose his radial artery. The artery was drawn from its sheath, cut squarely across, a tube was inserted in its lumen and the blood from his body permitted to flow into a vein of the unconscious child, the arms of the donor and the recipient being bound closely together. This juxtaposition was continued for twenty minutes or more. The pain to the donor was sickening, a pulsating drag on the incised artery and its moving contact against the sensitive cut skin; the danger was frightful, for let but one of those minute organisms causing the blood poisoning in the child enter into the circulation of the volunteer and his fate was sealed. Anxiously the group of physicians at the bedside watched the increasing pallor of the donor, and the tension became so great that they could hardly bear it. Then one of them (himself a volunteer) remarked: "How does it feel, Larry, to be a martyr?" and in the smile which followed, the situation was saved. And the story was related because of its humor!

To attain success in the practise of medicine a man must possess knowledge to decide and courage to perform combined with a love for truth, honor, justice and purity. Such success means for the most part moderate competency, a large part of the compensation being its scientific interest and the satisfaction experienced by the knowledge of a duty well performed; any one who has experienced the satisfaction of alleviating pain or saving life will not underrate this compensation. It can not be estimated in money terms, but even in this mercantile age the average physician is one who feels more satisfaction in the thought that he has saved the life of a child for its parents, or that of a mother for her children, than would come to him in the enjoyment of the steam yacht of modern high finance. As a money-making profession medicine ranks low. The same capital, industry and time would bring a larger financial return in almost any other calling. At present it may be said of the profession that most of its votaries make a modest income and but few a large income, though it can not be denied that there are a few who enjoy very large incomes derived from the profession of medicine. Any one who estimates the values which money can buy as above those which I have tried to indicate would do well to choose some other profession.

But there are also other advantages in the profession of medicine as a life work.

In the first place it is essentially a gentleman's profession. No one can succeed in it unless he be a gentleman at heart, and this fact, well understood, admits him into the best and pleasantest circles of the social community. He meets people of culture; he associates with educated men and women; with those who make and administer our laws and who direct our charities and educational institutions. Such environment is enormously stimulating to his intellectual life.

In spite of the fact that he is anybody's servant, he is nevertheless his own master. He can arrange his work to suit himself and he submits to no dictation as to how it shall be done. It is he who decides what he shall do and how he shall do it. He is not, as in so many other occupations, the instrument of another's will.

Notwithstanding the fact of the arduousness of his calling, he has, of course, his periods of leisure, and this leisure is at his own disposal, as is the case in few other occupations. His home life is perhaps more complete than is found in any other

occupation excepting the ministry. His reading is broad, and always dealing with new things, and in this way his interests are continually broadening.

Another advantage of his profession is his association with all classes of the community, with men, women and children, whereas in other callings his association is chiefly with men. In other words, he is studying humanity instead of pursuing the elusive dollar.

Mr. Barney, last week, spoke to you of the crowded condition of the profession of the law. The profession of medicine is also crowded. But reviewing the question judicially, so, it seems to me, are all the other professions and callings, this crowding and competition extending into every branch of human activity wherein men and women gain a livelihood. At the present time the only exception to this rule seems to be the general-housework girl!

Speaking of the profession of the law, it is customary to point out to aspirants for legal honors the value of a knowledge of law in other departments of human activity, and students are told of the immense collateral value of such a knowledge in politics; in administrative positions; in banking, real estate, insurance and other occupations; and the implication is made that medicine relates only to the simple practise of medicine. Such a conclusion as this is a greatly mistaken one. Medicine in recent years has experienced such a broadening of its field of usefulness as is the case in no other profession. The foundation of such institutions, the Rockefeller Institute, etc., has created an entirely new field for the physician in the direction of the research worker. Nearly every hospital of note throughout the country has established such laboratories for the study of the causes and prevention of disease, and it is a matter now beginning to be well understood that the duty of the hospital is not only to care for the sick, but to study new methods for the cure and prevention of disease among the well. Such positions as these call for highly trained medical men, and it is a field which will soon be greatly enlarged by the establishment of clinical chemical laboratories as well as those for pathological and bacteriological research.

The great expansion of our life insurance companies has necessitated the employment of a greatly increased number of physicians, and the time is not remote when these great institutions will understand the benefit which will accrue to them in the establishment of research workers who shall demonstrate lines upon which human life may be prolonged.

The increase in the size and number of charitable institutions also calls for a largely increased number of medical attendants and new necessities caused by our extending civilization are daily springing up—such necessities as the supervision of our water supplies; our drainage disposal; physical culture; quarantine regulations and board of health investigations. In fact all the great economic problems of the day are problems which must be largely decided by physicians; as examples of which attention is directed to the supremacy of the Japanese in their struggle against Russia, a supremacy largely due to the health and effectiveness of their troops, as perfected by physicians. And the German exploitation of Africa and the building of our own Panama Canal, were both rendered possible by the conquest of the tropics by the physician.

And we see the trained physician sought out as a teacher of sociology, of psychology, of zoology and physiology and in other fields as yet barely touched by the plough of progress. Such teaching posi-

tions can generally be associated with a position in a hospital or public institution also carrying a small salary, and afford a highly attractive means of gaining a modest livelihood.

The preparation for the practise of medicine calls for four years of hard but interesting work in the medical school, and at least one year's supplementary work in a hospital. The medical school work is elaborately described in all medical school catalogues. To describe it here would be beyond the scope of the present lecture. It might be briefly summed up as a study of the human body in health and disease, and the study of disease with its causes, prevention and treatment. The hospital work means the actual practise of medicine in the hospital under the direction of an experienced physician.

Now the preparation for the medical-school work in the college should in my mind be somewhat along the following lines:

In the first place I would advise every student to do some work every day. The enthusiastic student could do more, and the less enthusiastic less, but I would advise every student to do some, and it is astonishing how much one can accomplish by steady persistent routine work, even if but little time is devoted to it. And I would also advise every student to study some subject thoroughly, the idea being that he should understand what it involves to acquire accurate, precise knowledge; partly that he should have the benefit of the mental training thereof, and partly that he should have the direct benefit of the knowledge itself.

Lord Broughton's ideal of education was to know something of everything and everything of something. Of course that is not practical now-a-days when knowledge is so diverse and extensive, but to know a few subjects pretty well and one subject very well seems to me to be all we have a right to expect from the average college student. To express this in different terms; I mean that it is fair to at least ask of a conscientious student that he should each year receive a good passing mark in all his studies and an A or B in one. Another thing which he should get from this college training is a good physique, for the mere physical work of the study and practise of medicine is such as to demand a strong and vigorous body. Epictetus said that he was a spirit dragging about a corpse! Let no such spirit as this contemplate the study of medicine! And he should have a well-disciplined mind, because the study and practise of medicine call for a high degree of self-control.

Special studies given in the college which will be of inestimable value to him in the medical school are biology (including botany), physics, chemistry, Latin and Greek, English, German and French.

I have placed biology first because I consider it of the first importance, and let me say, in passing, that you, as students of Tufts College, are fortunate in having at the head of your department of biology one of the most distinguished biologists in the country. It is a great privilege to be allowed to sit under this inspiring teacher and at the risk of making myself unpopular with him, I would advise every student in the college, no matter what he intends to be, to take at least one course in biology, that he may learn what science and scientific methods really mean. By studying biology you not only are enabled to form a pretty correct idea as to what the study of medicine is like; to judge whether or no you are likely to make a success of it; you not only familiarize yourselves with the scientific methods of study, cultivating

your powers of observation, of noticing similarities and differences, and of describing what you see, learning to use the scalpel and the microscope; but you also store your mind with a knowledge of facts, processes and methods which will later be of direct value to you in the study of medicine. It would be hard for you to realize how much time is lost in teaching medical students these methods of study which each one of you should acquire without unusual effort in your college course. It is sometimes said of the work in college that it is not so much the things you learn as the knowledge of how to learn which is valuable to the student in after life. I think this statement conveys a false impression. It seems to me that the college student preparing himself for the study of medicine can not only learn how to study to the greatest advantage, but that he can also store his mind with facts and principles which will be of enormous value to him. I believe that the mind should be regarded in part as a storehouse of facts, which can be drawn upon in emergency like a balance in the bank. I have never heard any one question the utility of a bank balance unless perchance it was too large! Another advantage to the medical student of the study of biology in college is that it familiarizes him with animal life in its simplest forms before he begins to study it in its most complex form as evinced in man. By such study he is enabled to take a bird's eye view, as it were, of his subject before he devotes himself to its intimate study. It is like studying the map of a city before we explore the city.

Second to the study of biology, in its importance to the medical student, I should rank physics. No one can properly understand the various processes of the human body who does not possess a knowledge of physics. Everything we do, everything we say, everything we think and everything that goes on within us is due to physical cause, and a knowledge of these underlying physical principles is absolutely essential to a knowledge of medicine. I rank physics second to biology only because some knowledge of physics must of necessity be included in a knowledge of biology.

Third on my list of collateral studies comes chemistry. A knowledge of chemistry is of absolute necessity to the medical student because it deals with the composition of everything he comes in contact with. Before he can study material things to advantage he must know of what they are composed. So important is chemistry that it is taught in the different degrees in every medical school in the country, but it would be of the greatest advantage to the prospective medical student if he could obtain a good general knowledge of organic and inorganic chemistry, including qualitative and quantitative analysis, before he entered the medical school; it would give him extra time for his purely medical studies, and it would enable him to master more easily his biological and medical chemistry. Chemistry, as you know, has a language of its own and a great saving of time is made if the language alone is acquired.

Fourth in importance in the list of collateral studies is Latin, important to medical men because it is the language of the scholar and because medical men should be preeminently scholars. The language of medicine is essentially derived from the classics; every bone and every muscle, every artery and every vein; every nerve and every organ is described in terms of classical derivation. So also are all the drugs, and even our prescriptions are written in Latin, though the Latin in some instances would give Cicero a surprise he

would never recover from! Some knowledge of Latin is essential; a more extended knowledge is highly desirable as an accessory aid to memory.

Advanced English I place fifth in my list, giving it a lower place because a knowledge of English is presupposed. But in including it I mean to advise the more advanced and critical knowledge of the language; a knowledge which permits us to speak and write it fluently and elegantly. A knowledge which has enlarged our vocabulary and has made us widely acquainted with English literature and its development—a knowledge which has developed the reading habit and which makes us familiar with other people's thoughts and habits of thought. If I were to teach English to prospective medical students, I should also lay great stress upon the daily theme upon current events.

German and French I place sixth and seventh in my list as valuable chiefly by enabling us to become conversant with the literature and scientific progress of other nations and peoples. One or more foreign medical journals a week help one amazingly to keep pace with foreign progress. German and French are valuable, too, as enabling us to communicate at first hand with foreigners if we study abroad, or with our foreign patients in practise at home. Few persons, not physicians, realize how greatly our foreign population is increasing. I remember at my clinic one day, when I was late, and four children had been kept for me to examine, that one was an Italian, one a Russian, one a Greek and one a Syrian!

Economics and sociology would come eighth and ninth in the procession, both of immense importance to the medical man; tenth and eleventh, at the risk of being called an iconoclast, I should rank drawing and painting, and shorthand writing, and to round out the dozen, let us add public speaking.

These subjects will not, of course, occupy the student's whole time while in college. Place is left for other elective studies. In these other elective fields the student can roam according to his fancy. The suggested studies form the basis of his work; the supplementary excursions furnish variety. Nothing is lost from the broadening effects of his college course, but much is gained from its concentration.

And now, before I release you for your short respite of well-earned leisure, let me quote to you the words of Kipling to the students in a London Hospital, and say that I need not "stretch your patience by talking to you about the high ideals and lofty ethics of a profession which exacts from its followers the largest responsibility and the highest death rate—for its practitioners—of any profession in the world. If you will let me, I will wish you in your future what all men desire—enough work to do and strength enough to do the work."

Harold Williams
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An International Cooperative Investigation on Electrical Standards

The International Electrical Conference, which met in London in October, 1908, passed certain resolutions with regard to electrical units and standards, but left to an international committee, which was established at that time, the duty of completing the specifications for the concrete electrical standards, and of deciding upon a new numerical value for the Weston normal cell which could be adopted internationally.

As is well known, the value for the Clark standard cell (1.434 volts at 15° C.) which was adopted by the Chicago Electrical Congress in 1893, was not accepted by Germany. After further experimental investigations, Germany adopted the value, 1.4328 volts at 15° C. England, America, France and some

other countries have followed the Chicago Congress, whereas other countries have followed Germany, and hence there have been two different values for the volt in use.

In course of time, the method of preparation of the Clark cell was improved so that the cell became more reliable, but at the same time its electromotive force was slightly altered. At the Bureau of Standards, an allowance was made for the change in the E.M.F. of the Clark cell, so as to preserve the unit of electromotive force unaltered. In England, however, the original numerical value was retained in spite of the fact that the new cells had slightly different values from the old. The result was that a discrepancy arose between the values in use in England and America. Hence, there were and still are three different volts in use in different countries. The Weston normal cell, officially adopted at the London Conference in place of the Clark cell, has the following values: In America, 1.0189 at 25°, equivalent to 1.019125 volts at 20°; in Germany, 1.0186 volts at 20°; in England, 1.0184 volts at 20°. Some of the other countries have the same value as America, others the same as Germany. England adopted the last-named value only one year ago, and no other country, as far as known, has followed its example.

The London Conference of 1908 adopted the ohm as represented by the resistance of a specified column of mercury, and the ampere as represented by a certain mass of silver deposited in a silver voltameter, as the two independent fundamental electrical units, and declared that the value of the volt should be derived from these two. The electrochemical equivalent of silver adopted at London was 1.11800 milligrams of silver per second per ampere of current. It was known that different investigators had obtained different values for the electrochemical equivalent of silver, according to the kind of voltameter used and the methods of preparing the silver nitrate, so that the international committee found itself confronted with the problem of preparing specifications for the voltameter, when there was a great difference of opinion as to the proper procedure and as to the true value of the electrochemical equivalent of silver, which had, however, been definitely fixed by the conference.

The International Committee on Electrical Units and Standards is authorized by the London Conference to complete the work of the conference and to carry on intercomparisons of standards among different countries, and to promote investigations upon the subject of electrical units and standards, to the end of securing international uniformity with the highest obtainable accuracy. This committee represents eleven different countries, there being two members each from America, England, France and Germany, and one member each from Austria, Italy, Russia, Switzerland, Holland, Belgium and Japan. The president of the committee is Professor Dr. E. Warburg, president of the Reichsanstalt, Berlin; vice-president, Dr. R. T. Glazebrook, director of the National Physical Laboratory, London; treasurer, Professor S. W. Stratton, director of the Bureau of Standards; secretary, Professor E. B. Rosa, physicist of the Bureau of Standards. The other eleven members of the committee are as follows: Dr. Osuke Asano, Department of Communications, Tokyo, Japan; M. René Benoît, Bureau International, Sevres, France; Dr. N. Egeroff, director, General Chamber of Weights and Measures, St. Petersburg, Russia; Professor Eric Gérard, Liège, Belgium; Professor H. Haga, Groningen, Holland; Dr. Ludwig Kusminsky, Commission of Weights and Measures, Vienna, Austria; Dr. Stephen Lindeck, Physikalisch-Technische Reichsanstalt, Berlin, Germany; Professor Gabriel Lippmann, The Sorbonne, Paris; Professor Antonio Ròiti, Florence, Italy; Mr. A. P. Trotter, Electrical Standards Laboratory, Whitehall, London; Professor H. F. Weber, Zürich, Switzerland.

In addition to the fifteen members appointed by the International Electrical Conference, the committee was authorized to elect associate members to assist in carrying on its work, and at its first meeting in London, following the conference, five associate members were elected as follows: Dr. W. Jaeger, of Berlin; Mr. F. E. Smith, of Lon-

don; Professor Paul Janet, of Paris; Professor H. S. Carhart, of Ann Arbor, Michigan, and Dr. F. A. Wolff, of the Bureau of Standards, Washington.

It was impossible to select a new value of the Weston normal cell in terms of the ohm and the ampere until the latter should be more precisely defined than had been done by the London Conference. Correspondence among the members of the committee who were connected with national standardizing institutions seemed to indicate that it would be impossible to agree upon the specifications of the silver voltameter without further investigation, and it was proposed by the American members of the committee that a joint investigation to clear up, as far as possible, outstanding problems on the standard cell and the silver voltameter be arranged with representatives of several of the national standardizing laboratories as participants. Professor S. W. Stratton in his capacity as director of the Bureau of Standards offered the facilities of the Bureau of Standards for an international investigation, and in his capacity as treasurer of the International Committee on Electrical Units and Standards offered to secure the funds to pay the expenses of the investigation. In this connection he received valuable assistance from Mr. John W. Lieb, Jr., who placed the matter before the governing bodies of the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illuminating Companies and the Illuminating Engineering Society. These four societies made appropriations of $500 each to defray the expenses of the proposed investigation. Their generosity in this matter is very highly appreciated by the International Committee on Electrical Units and Standards. Some smaller contributions were also received.

It was arranged that the proposed investigation should be carried out at the Bureau of Standards by representatives of that institution together with one delegate from the Physikalisch-Technische Reichsanstalt, Berlin, one from the National Physical Laboratory, London, and one from the Laboratoire Central d'Electricité, Paris. The European delegates, as appointed by the directors of the three above named institutions, are Professor W. Jaeger, Mr. F. E. Smith and Professor F. Laporte. These gentlemen have had a very considerable experience in work with standard cells and silver voltameters, have published various investigations on the same, and are eminently qualified to represent their respective institutions and to join in the work of research and deliberation upon the various questions that will arise during their stay in Washington. The representatives of the Bureau of Standards are Professor E. B. Rosa and Dr. F. A. Wolff. In addition to published papers, a great deal of experimental work has been done at the Bureau of Standards which is not yet published, which throws considerable light upon the questions at issue.

In addition to the work on standard cells and the silver voltameter, a comparison is to be made of the resistance standards of the several national standardizing institutions. The wire standards of the Reichsanstalt, the National Physical Laboratory and the Bureau of Standards differed only about two parts in a hundred thousand at the last intercomparison about a year ago, the standards of the first two of the above institutions having been fixed independently by legally specified mercury ohms. It is expected that a common value of the international ohm will be agreed upon, so that no difference greater than one part in a hundred thousand will exist between the wire standards of the national standardizing institutions.

It is confidently expected that the committee will succeed in coming to a satisfactory agreement with respect to the official specifications of the silver voltameter and the Weston normal cell, and will be able to agree upon a value for the latter which can be recommended to all countries of the world for adoption. The degree of accuracy which is now obtainable in electrical measurements, both in absolute measurements and in relative measurements, far surpasses what was possible in 1893, and indeed has increased greatly within the last five years. There is

reason to believe that values adopted now will be satisfactory for a generation at least without change. The European delegates have brought with them, from their own laboratories, a quantity of apparatus and chemicals in order that they may reproduce work done in their own laboratories at the Bureau of Standards, as accurately as possible. Standard cells will be set up by the representatives of each of the four institutions, and accurately compared and tested. In the same way different forms of silver voltameters will be operated in series with one another, and the quantity of silver deposited in each determined with very great accuracy. The Bureau of Standards has provided every facility for carrying on this work expeditiously and with the highest precision.

The three European delegates arrived from Europe recently, and proceeded to Washington after a short stay in New York, in time to begin their work at the appointed time, April 1. It is not known how long the work will continue, but it is hoped to complete it in two months.

EDWARD B. ROSA

FEDERAL EXPENDITURES FOR THE CONSERVATION OF THE NATIONAL HEALTH

CERTAIN contributors to *American Health* (the official organ of the American Health League, published by the Committee of One Hundred) have expressed the opinion, that while the care and health of animals is a matter of extreme importance to the federal government, the health of human beings, on the other hand, is a matter of indifference. At least, this is what one would infer from the following quotations taken from *American Health:*

John Pease Norton, Ph.D., *American Health*, March, 1908, page 12:

We look with horror on the black plague of the middle ages. The black waste was but a passing cloud compared with the white waste visitation. Of the people living to-day over eight millions will die of tuberculosis, and the federal government does not raise a hand to help them.

THE DEPARTMENT OF AGRICULTURE PROTECTS ANIMALS

The Department of Agriculture spends seven million dollars on plant health and animal health every year, but, with the exception of the splendid work done by Doctors Wiley, Atwater and Benedict, Congress does not directly appropriate one cent for promoting the physical well-being of babies. Thousands have been expended in stamping out cholera among swine, but not one dollar was ever voted for eradicating pneumonia among human beings.

Mrs. Gibson Arnoldi, Bulletin of the Committee of One Hundred on National Health, September, 1909, page 8:

The national government of the United States spends $7,000,000 on plant and animal health every year, and hundreds of thousands fighting beetles and potato bugs, but not one cent to aid the six million babies that will die under two years of age during the next census period while mothers sit by and watch in utter helplessness. This number could probably be decreased by as much as one half. Why is nothing done? . . .

Bulletin No. 33 of the Committee of One Hundred on National Health, October 1909:

At a meeting held in Denver in August an interesting paper on meat inspection was read by Miss Lakey, chairman of the food committee of the National Consumers' League. Resolutions were adopted recommending that states and cities should provide more sanitary slaughter houses. Miss Lakey showed that the federal inspection is inadequate.

To those who are more familiar with the health work now being carried on by the federal government here at Washington and in its branch laboratories, these statements, while correct as to certain details, are objectionable because of their implications. The above quotation from Bulletin 33, for example, was so placed as to carry (to the writer at least) the impression that the federal inspection was being criticized, not alone as to the quantity of meat inspected, but also as to the quality of the inspection. The writer has been corrected by one who attended the Denver meeting of the Association of State and National Food and Dairy Departments, and informed that the federal meat inspection service was held up by Miss Lakey as a good

example to be aggressively followed by state and municipal health boards. Inefficiency was not implied.

The object of this article is not to criticize these contributors or the Committee of One Hundred, but rather to point out that, far from being a matter of indifference, the national health is a matter of the gravest concern.

For what purpose is the health work now being carried on in the following federal departments?

First: The Bureau of Chemistry. The work of this bureau (involving an annual expenditure of approximately $750,000), particularly in the enforcement of the food and drugs act, is too well known to need description here. Even the babies have not been forgotten; the composition and digestibility of baby foods have been studied; a more detailed and thorough study of the subject has been planned and will probably be in progress in the near future. Considerable work is being done upon "soothing syrups" manufactured and sold in violation of the food and drugs act.

Second: The Hygienic Laboratory of the Public Health and Marine Hospital Service. This laboratory has made investigations along several lines. Certain parasitic diseases in *man* (*e. g.*, hook-worm disease) have been studied; milk and its relation to the public health has been a subject of both extensive and intensive research. Investigations of the dissemination of tuberculosis and typhoid fever through interstate traffic are in progress. The Marine Hospital Service maintains the federal quarantine (appropriation—$400,000 for the fiscal year ending June 30, 1909). For the same year congress appropriated $700,000 to be used by the Public Health and Marine Hospital Service "in case of threatened or actual epidemic of cholera, typhus fever . . . in aid of state and local boards . . . in preventing and suppressing the spread of same. . . ."

Third: The investigations on the food and nutrition of man now being carried on through the Office of Experiment Stations. Likewise, of undoubted value is the work of the Surgeon General of the United States Army. The work done by that office in pointing out the relation between the mosquito and the spread of yellow fever is obviously of vital importance.

Fourth: The Bureau of Animal Industry. In this bureau the federal health work is being carried on through several of its divisions. The Meat Inspection Division (for which congress appropriates $3,000,000 per year) inspects the inter-state traffic in meat, thus assuring the country a clean meat supply. Hook worm in man was first suspected through the work that has been done with this parasite in animals.

To certain criticisms of the federal inspection a very interesting reply by the Bureau of Animal Industry is to be found in the Twenty-third Annual Report of that bureau for 1906, page 443, *et seq.*

The Dairy Division is making every effort to cleanse and purify and improve the milk and dairy products of the country. The proper construction, care and ventilation of the barn, as well as improved methods of making cheese, are subjects of investigation. For the inspection of butter-renovating factories $10,000 are expended annually. For investigations on methods of improving the quality and quantity of dairy products, $30,000 are expended annually.

If the amount of money expended by the federal government through these several bureaus (considerably over $4,000,000 per annum) may be taken as a correct measure of the interest taken in their work, it follows that the national health is a matter of something more than incidental interest to the federal authorities. The above-mentioned amounts, however, do not by any means represent the total amount expended through channels making for the national health. If the eating of certain abnormal varieties of corn in certain localities induces seriously diseased conditions in the people eating it, is the expenditure in studying the biology of the corn any less useful than that in studying the disease in man?

The relations of some of the branches of federal activity to the public health are very direct and obvious. Some of the investigations of the Hygienic Laboratory of the Public Health and Marine Hospital Service, for example, resulting in the tracing of typhoid fever to contaminated milk, are evidently made for the immediate protection of the public. The work of the Meat Inspection Division in preventing the sale of the meat of diseased animals is just as immediate in its purpose. It is evident that a plentiful supply of wholesome food is as essential to the health of a people as any other measure for the prevention or eradication of disease. Well-nourished bodies may resist disease where impoverished ones succumb.

But the bearings of other branches of federal activity upon the public health may not be so obvious to the superficial or casual observer. To such an observer the study of the proper construction and ventilation of a barn may not be as close to the public health as the study of the properties of an antitoxic serum. But in these days of preventive medicine we are willing not alone to be cured of disease, but even to prevent it in almost any way whatsoever—for example, by using only clean milk, from clean, healthy cows, and which obviously can only be kept clean and healthy in barns of sanitary construction and ventilation. The enemy (the pathogenic microorganism in this case) will enter through any gate. All of them must be closed.

The figures quoted above have been taken from Document No. 1,031, House of Representatives (Treasury Department Document No. 2,516), Estimates of Appropriations for the fiscal year ending June 30, 1910; also, Treasury Department Document No. 2,533, Statements of Balances, Appropriations and Disbursements of the Government for the fiscal year ended June 30, 1908. Both of these publications are easily obtainable by those interested, at the Library of the U. S. Department of Agriculture.

W. N. BERG

WASHINGTON, D. C.

A DEPARTMENT OF PUBLIC HEALTH

SENATOR OWEN has introduced in the senate a bill establishing a Department of Public Health, which has been read twice and referred to the Committee on Public Health and National Quarantine. The principle of this bill has been approved by the committee of one hundred of the American Association for the Advancement of Science, and members of the Association are urged to make efforts to secure the passage of the bill, more especially by writing letters to members of congress endorsing the *principle* of the bill and in favor of a wide extension of the present health work of the national government.

President Taft, in his public addresses, as in his first annual message to congress, both the great political parties in their platforms, the National Grange, the American Federation of Labor, the American Medical Association, the Committee of One Hundred, and others, have put themselves on record as in favor of a broad reform of the existing situation. It is important to impress upon congress that there is a thoughtful and widespread demand in this country for comprehensive reform at this time.

THE AMERICAN CHEMICAL SOCIETY

THE summer meeting of the American Chemical Society, to be held in San Francisco, July 12–15, 1910, promises to be one of the pleasantest outings ever enjoyed by the members of the society.

A special train made up of the Santa Fe's finest equipment will leave Chicago on the evening of July 4, arriving at Colorado Springs on the morning of July 6. About six hours will be allowed for a trip to Manitou, the Garden of the Gods or to the top of Pikes Peak. Leaving about one o'clock the train will reach Adamana on July 7 and a half day will be spent in a visit to the Petrified Forests, two of which and possibly three may be examined. Leaving Adamana that night the party will arrive at the Grand Canyon of the Colorado on the morning of July 8 where the day will be spent. Leaving the Grand Canyon that evening the train will arrive at Redlands

and Riverside, California, the following afternoon and about two hours and a half will be given to the semi-tropical scenery of each of these two cities. Sunday, July 10, will be spent at Los Angeles, leaving there in the evening and arriving at Lang, Cal., on the following morning. At Lang the borax mines will be visited on invitation of Mr. S. T. Mather, of the Thorkildsen-Mather Company, where the party will be their guests until about 1:30 o'clock, when the train will leave for Santa Barbara, giving us about five hours in that unequalled seaside resort. During the night the train will leave for San Francisco via the coast route of the Southern Pacific, probably reaching our destination about twelve o'clock on July 12.

The meeting will follow and our entertainment by the California Section. The tentative program for our entertainment includes: first, a steamer trip around the Bay and out through the Golden Gate; second, a trip to the top of Mt. Tamalpais and to the Muir Woods, the first giving us an extensive view of the ocean, the bay and the surrounding mountains and hills, while the second contains fine specimens of the coast redwood (*Sequoia sempervirens*); third, an excursion on the Ocean Shore Railway to Pescadero with a possible return via the Santa Clara Valley; fourth, an excursion to the vineyards and wineries of the Italian-Swiss colonies in Sonoma County; fifth, a visit to the University of California at Berkeley; sixth, a visit to Stanford University with a possible automobile trip through the orchards of the Santa Clara Valley; seventh, a camping out trip for one night and parts of two days into the Big Basin, the State Park, where some of the biggest redwoods are to be seen; also it is hoped to visit some of the local manufacturing plants.

Following the meeting the party will dissolve as a whole, returning as they desire, either via the smelters in Utah and Colorado, via the beautiful scenery of the Canadian Pacific, or via the National Yellowstone Park.

Unusually low rates have been obtained from Chicago; namely, $62.50 for the round trip from that city with $15 extra if the party returns via the northern routes. There will be $6.50 extra railway fare on the side trip to the Grand Canyon. The berth rate from Chicago to San Francisco will be $14 with an additional charge for the four extra days in transit in lieu of hotel expenses, as the Pullmans will be used throughout the trip. This additional charge will approximate $7 on the berth rate.

The Puget Sound Section are hoping that a considerable number of the members may decide to return via Seattle and if a party can be formed they will make every effort to show us their own delightful surroundings.

In view of the efforts that are being made by the California members and of the unusual attractions of the trip, it is hoped that a special effort will be made by eastern members to be present at the meeting. Reservations for the special train will be made in the order of their receipt. Any members of allied societies going west at this time who may wish to share in the privileges of the special train should address the secretary, Charles L. Parsons, New Hampshire College, Durham, N. H.

SCIENTIFIC NOTES AND NEWS

Before the Paris Academy of Sciences on March 4, M. Picard made a eulogy on the late Alexander Agassiz. Mr. Agassiz had attended a meeting of the academy two weeks previously.

The will of Alexander Agassiz, dated September 17, 1906, was filed at Newport, on April 14. He bequeathed $200,000 to Harvard University, half for the Museum of Comparative Zoology and half for its publications. The university also receives scientific apparatus and books, and will ultimately receive the further sum of $12,000. Mr. Agassiz further bequeathed $50,000 to the National Academy of Sciences and an equal sum to the American Academy of Arts and Sciences. $25,000 is left to the Newport School of Manual Training, to which ultimately $6,000 will be added. Mr. Agassiz's will further provides that in the case of the death of any one of his three sons without issue his share of the estate shall ultimately go to Harvard University for the Museum of Comparative Zoology.

ON the occasion of the retirement of Dr. Charles F. Chandler, head of the Department of Chemistry of Columbia University, a testimonial is to be tendered in his honor under the auspices of the Chemists' Club, the Society of Chemical Industry, the American Chemical Society, the American Electro-Chemical Society, the American Institute of Chemical Engineers and the Verein Deutscher Chemiker. The form of the testimonial has been arranged as follows: first, a banquet at the Waldorf-Astoria, on Saturday, April 30, at 7 P.M.; second, the presentation of a bronze bust in heroic size, to be executed by Mr. J. Scott Hartley, which bust it is expected will finally be presented to the Chandler Museum of Columbia University, while a replica will be presented to Mrs. Chandler, and third, the creation of a Chandler testimonial fund for the purpose of purchasing books for the library of the Chemists' Club. Subscriptions for the dinner (five dollars) and to the testimonial may be sent to the treasurer of the committee of arrangements, Dr. Morris Loeb, 273 Madison Avenue, New York City.

SIR WILLIAM RAMSAY will be president of the British Association for the meeting to be held next year at Portsmouth.

ON the occasion of the installation of the Duke of Devonshire as chancellor of the University of Leeds, on June 11, the degree of doctor of science will be conferred on Lord Rayleigh, Sir Clements Markham and Dr. Osler.

THE Royal College of Surgeons of England has awarded a gold medal to Dr. Robert Fletcher, principal assistant librarian of the library of the surgeon general's office in Washington, in recognition of his services in connection with the indexing of the catalogue of that library.

THE Philadelphia Geographical Society has conferred its gold medal on Commander Robert E. Peary, who lectured before it.

SIR HARRY JOHNSTON, G.C.M.G., has been elected a corresponding member of the Italian Geographical Society.

A MALACOLOGICAL CLUB has been formed at Boston, with Professor E. S. Morse as the first president.

PRESIDENT CHARLES R. VAN HISE, of the University of Wisconsin, will attend the International Geological Congress at Stockholm, Sweden, this summer, sailing from Quebec on July 1 for Liverpool. He may be accompanied by Professor C. K. Leith of the geological department.

DR. GEORGE GRANT MACCURDY has been appointed to represent Yale University at the International Congress of Americanists to be held in the City of Mexico, September 8 to 14, 1910.

PROFESSOR POULTON, F.R.S., Dr. Dixey, fellow of Wadham College, and Dr. Malcolm Burr, New College, have been appointed as representatives of Oxford University at the International Congress of Entomology to be held at Brussels in August next.

DR. ARTHUR TWINING HADLEY, president of Yale University, has accepted an invitation to deliver the golden jubilee address before the University of California on May 17.

THE council of the Institute of Metals, London, has initiated an annual series of May lectures. The first will be given on May 24 by Professor W. Gowland, F.R.S., on "The Art of Working Metals in Japan."

PROFESSOR WILLIAM GRAHAM SUMNER, of Yale University, eminent for his contributions to sociology and economics, died on April 12, at the age of sixty-nine years.

THE Rev. Jeremiah Lott Zabriskie, known for his work in entomology and microscopy, died at his home in Brooklyn, on April 2, at the age of seventy-five years.

SIR ROBERT GIFFEN, the eminent British statistician, died on April 12, at the age of seventy-three years.

PROFESSOR JULIEN FRAIPONT, rector of the University of Liége, well known for his writings on anthropology and geology, died on March 22 in his fifty-third year.

MR. ADOLPH LEWISOHN has given $130,000 to Mt. Sinai Hospital for the erection of a pathological laboratory.

We learn from *Nature* that the valuable collection of shells formed by the late Mr. Thomas Gray, of Glasgow, who died recently at the advanced age of eighty-nine, has been left by him to Kelvingrove Museum, Glasgow. More than 7,000 species of shells are represented in the collection.

Professor Hilary Bauerman, of London, who died on December 5, aged seventy-five, leaving an estate of the value of £15,000, bequeathed £500 to the memorial fund of the Iron and Steel Institute. The residue of his property he left subject to a life interest, to be applied in the encouragement of the study of mineralogical science at the Royal School of Mines.

President Taft sent to congress on April 9 a message recommending an appropriation of $50,000 for a laboratory in which to conduct investigations on cancer. "The very great importance of pursuing the investigation into the cause of cancer," said the president, "can not be brought home to the congress or to the public more acutely than by inviting attention to the memorandum of Dr. Gaylord herewith. Progress in the prevention and treatment of human diseases has been marvelously aided by an investigation into some diseases in those of the lower animals which are subject to it, and we have every reason to believe that a close investigation into the subject of cancer in fishes, which are frequently swept away by an epidemic of it, may give us light upon this dreadful human scourge."

Cincinnati's city council has repealed the ordinance passed a year ago whereby "more daylight was to be gained for workers by setting local clocks two hours fast from May to October of each year."

A letter has been received from Professor E. B. Frost, director of the Yerkes Observatory, regarding recent observations of Halley's Comet made at that place. On April 12 Professor Frost found the comet more conspicuous than the adjacent star *c Piscium,* and Professor Barnard estimated the nucleus, which was not stellar, to be two magnitudes fainter than this star. On April 14 the comet was photographed with 6 m. exposure. No tail was visible with any of the instruments. Visual observations of the spectrum were made by Professor Frost and Dr. Slocum, and showed a distinct continuous spectrum from the nucleus. No bright bands or lines were seen. The intensity of the continuous spectrum, relative to the emission bands, has greatly changed since the comet was visible in the evening.

The Harpswell Laboratory, at South Harpswell, Me., will be open to investigators during the present summer from June 20 until September 1. Owing to the absence of Dr. Kingsley in Europe it will be under the charge of Professor H. V. Neal, of Knox College, Galesburg, Ill., to whom all communications and applications for places should be addressed. Thanks to the participation of several colleges and universities, the laboratory is in a position to offer its facilities free to all who are desirous of carrying on investigations on the northern fauna or flora. There are only nine rooms available for students, and as some of these are already engaged, an early application for places is advisable. No circulars will be issued this year.

The seventh annual session of the Puget Sound Marine Station, located at Friday Harbor in the State of Washington, will commence on June 28 and continue till August 8, 1910. This station, which is conducted upon a cooperative basis through the affiliation of a number of the educational institutions of the northwest, will open this season with greatly increased facilities. A laboratory building is under construction which will be available for use at the beginning of the coming session. This structure will be provided with running water, both fresh and salt, research rooms for investigators, dark room for photography, facilities for elementary instruction and a small but well selected library bearing upon the natural history of the northwest. The equipment includes a steamer fitted with dredging apparatus for deep water work and small boats for shore collecting. Provision has been made for elementary classes as well as for advanced students and for investigators who wish to pursue individual re-

searches. Among those who will offer courses at the station during the coming session are the following: Trevor Kincaid, professor of zoology, University of Washington; Nathaniel L. Gardner, acting professor of botany, University of California; W. J. Baumgartner, assistant professor of zoology, University of Kansas; Geo. B. Riggs, assistant professor of botany, University of Washington; W. L. Moodie, instructor in botany, Bellingham State Normal School; F. A. Hartman, instructor in zoology, Seattle High School. For those wishing to investigate the marine fauna and flora of the northwest coast the Puget Sound Marine Station, located in the midst of a picturesque archipelago of rocky islands, offers an unsurpassed opportunity. Further information with regard to the station will be supplied by the director, Professor Trevor Kincaid, University of Washington, Seattle, Wash.

UNIVERSITY AND EDUCATIONAL NEWS

JOHNS HOPKINS UNIVERSITY has received an offer of $250,000 from the General Education Board for the purpose of aiding the university in its efforts to put into operation certain extensions and improvements that have been under consideration for several years, including the erection of new buildings on the Homewood site. This sum will be contributed conditional on the raising of a supplementary sum of $750,000 by the university by December 31, 1910. The university, however, is endeavoring to raise $2,000,000, half for new buildings, while the other $1,000,000 will be used for endowment. Among the extensions contemplated are a school of engineering; a law school; a training school for teachers; a department of preventive medicine, and a building for pathology.

A JOINT hearing on the bills to appropriate $652,000 for new buildings for the College of Agriculture and $130,000 for new buildings for the Veterinary College at Cornell University was given on April 5 by the finance committee of the senate and the ways and means committee of the assembly. Thirty-six persons spoke in favor of the bills and nobody appeared in opposition to them. From the standpoint of the colleges addresses were given by Acting Director H. J. Webber, Dr. V. A. Moore and Director L. H. Bailey. The hearing was closed by President Schurman's address summarizing the argument.

DR. CHEESMAN A. HERRICK, formerly principal of the William Penn high school for girls, was installed as president of Girard College on April 2.

DR. ALBERT E. GIESCKE, an American and a graduate of Cornell University in political science, has been elected rector of the University of Cuzco, Peru. This university was founded by a papal decree of 1692. Dr. Giescke went there as a member of the faculty in 1908.

AT Stanford University appointments have been made as follows: E. W. Ponzzer, of the University of Illinois, assistant professor of applied mathematics; Hans Zinsser, instructor in bacteriology in Columbia University, associate professor of bacteriology; Frank P. Blaisdell, assistant professor of anatomy; David M. Folsom, assistant professor of mining; Galen H. Clevenger, assistant professor of metallurgy; Rufus C. Bentley and Lewis M. Terman, assistant professors of education. As instructors have been appointed Perley A. Ross, in physics, and George F. McEwen, in applied mathematics. The following promotions have been made: George C. Price, now associate professor, to be professor of zoology; George J. Peirce, now associate professor, to be professor of botany; William A. Hillebrand, now instructor in electrical engineering, to be assistant professor; Royce R. Long, now instructor in physical training, to be assistant professor; Luther W. Bahney, now instructor in metallurgy, to be assistant professor.

DISCUSSION AND CORRESPONDENCE

THE GERM THEORY OF DISEASE

IN SCIENCE for April 1, p. 500, Dr. Fielding H. Garrison has pointed out the true author of the germ theory. We can readily accept this until an earlier author is discovered by some one. Knowledge in most cases seems to

be built up from the investigations of a number of observers. Dr. Garrison closes his very interesting account by saying: "But no one ever thought of mosquitoes in relation to yellow fever before the time of Finlay and Walter Reed." Dr. Reed and his associates proved the theory, which was the all-important event, but it may not be amiss to call attention to an article published by Dr. Josiah C. Nott in 1848. He was evidently a learned physician of wide experience, a keen observer and reasoner, and in addition had a profound knowledge of the literature of zoology, particularly entomology. To what extent he anticipated present knowledge of the mosquito transmission of yellow fever may be somewhat a matter of opinion. The article is a most interesting one and will well repay perusal. It should be read in its entirety to get the proper conception of it and realize to what a remarkable degree the man was ahead of his day. The title is "Yellow Fever contrasted with Bilious Fever—Reasons for believing it a disease sui generis—Its mode of Propagation—Remote cause—Probable insect or animalcular origin, etc., by Josiah C. Nott, M.D., Mobile, Alabama. New Orleans Medical and Surgical Journal, IV., pp. 563–601, 1848." A few extracts may prove interesting, as this journal is not accessible to many persons.

I propose to now show, from facts presented during the various Epidemics in Mobile that the morbific cause of Yellow Fever is not amenable to any laws of gases, vapors, emanations, &c., but has an inherent power of propagation independent of motions of the atmosphere, and which accords in many respects with the peculiar habits and instincts of insects. . . . There are even perfectly authenticated instances where one side or end of a ship has suffered severely from this disease, whilst the other was entirely free from it! We can readily believe, that certain insects which are endowed with unaccountable instincts and habits might attack a part of a ship, or a tree, of a wheat or cotton field; but we can not imagine how a gas could be turned loose on one side of the cabin of a vessel and not extend to the other. . . . Yellow Fever can not be explained by the malarial[1] theory, and it must remain with the reader to determine whether the chain of analogies offered, render the Insect theory more probable. . . . With these facts before us, how much more easily may we account for the spread of yellow fever from a focus, by the insect, than by the malarial[1] hypothesis—here is something tangible and comprehensible.

In regard to cholera he says: "The history of these great epidemics which sweep over the surface of the globe affords very strong support to the Insect theory." Dr. Nott's remarks on vessel quarantine are in absolute accord with the knowledge and practise of today.

Henry Skinner
The Academy of Natural Sciences of Philadelphia

[1] Used in the sense of bad air.

Does excessive light limit tropical plankton?

To the Editor of Science: Among the numerous explanations of the richness of polar seas in plankton and the poverty of tropical waters, I fail to see any mention of the lethal effect of excessive light, yet this effect is so well known that we make daily use of sunlight to destroy pathogenic organisms, all of which flourish in the dark only. The tropics are rich in all land forms, but in every case there is some provision by which the protoplasm is protected from excessive light, and, as a matter of fact, the ordinary bacteria of northern latitudes do not flourish in the tropics. In the waters, on the other hand, unpigmented forms have nowhere to hide, as in caves, crevices, under rocks or under the shade of pigmented ones, except as parasites in the bodies of multicellular organisms, and must perish through this disinfecting power of the sun's rays. The same phenomenon has been found by the metropolitan sewage commission in the waters of New York harbor, where the winter flora derived from sewage is far richer than the summer.

The vernal increase of phyto-plankton in northern waters is the same phenomenon as the vernal increase of land plants—due to the return of the sun with non-lethal amounts of light which are utilized in the decomposition of carbon dioxide by the chlorophyl. To be sure, the increased temperature of the air is the main reason for renewed protoplasmic ac-

tivity of land forms in spring, but Herdman says[1] that "the temperature of the sea-water, however, appears to have little or no effect in determining the great vernal maximum of phyto-plankton." From this it is presumed that the richness decreases in the summer in spite of the warmer water, because the light becomes more or less destructive. It must be remembered that at 70° of north latitude the midday sun is just as strong on June 22 as it is at the tropic of cancer December 22.

There seems to be great confusion in literature on the effects of light, due to failure to distinguish between these two entirely distinct phenomena—(1) the stimulating or actinic effect on the living protoplasm and (2) the use of the energy of the rays to break up carbon dioxide in the chlorophyl-bearing cells. Plant-cells, as a matter of fact, like bacteria, function in absolute darkness, under the bark or in the roots, and do not need the slightest stimulation of light, indeed are killed by it, as a rule. Light is only used to build up the carbon food, and the cells engaged in this duty are also protected by the green pigment, hairs, etc., but even they are killed by two much light, as the botanists show—each species having its own danger limit which in the shade-loving plants is a very low one. Indeed, in botanical literature there are increasing numbers of references to the fact that the effect of light on plant protoplasm is to retard growth; while the effect on the chlorophyl is to supply carbon food for the cells under the bark.

It is quite evident, then, that the return of light in the spring starts the phyto-plankton to grow and multiply by furnishing more nutrition, but when the light gets so intense that it can penetrate in harmful degree to the protoplasm, growth is checked.

Dr. C. Stuart Gager's experiments with radium[2] are reported to show that in minimal amounts these powerful rays do not penetrate sufficiently to have any effect on the plant protoplasm, but above this minimum and up to an optimum they stimulate all functions. Beyond the optimum and up to the maximum their effect is a retardation or distortion of function, and beyond the maximum it is lethal. This is precisely the conclusion from the innumerable observations and experiments of the effects of light and ultra-violet on protoplasm of animals adjusted to a life in the light—man particularly—though as a matter of fact the stimulation of small amounts of light is not a vital necessity, as shown by the animals which have taken up residence in the deep sea or dark caves or have developed a nocturnal habit.

Curiously enough, though there are innumerable observations on the effects of minimal, optimal and maximal amounts of light on the plant as a whole, there are none which differentiate between the effects on the chlorophyl activity and the effects on the protoplasm. The radium rays have no known effect on the synthesis of the carbon compounds—the only rays effective there are small bands in the red or blue or both, and varying with different species. The radium effects are solely due to their influence upon the protoplasm under the bark. On the other hand, the well-known nocturnal growth of plants exposed to electric light is solely due to the increased food synthesis in the leaf, for it is not possible for these rays to penetrate the bark to effect the other cells which constitute the plant and construct its materials. It is so manifestly difficult or impossible to get light to penetrate bark evolved for the very purpose of excluding it, that we probably never shall know exactly how the various intensities of light affect the protoplasm of the higher plants, beyond the one undoubted fact that in amounts sufficient to penetrate thin skins it invariably retards growth or kills. In the case of unprotected unicellular plants, the case is different, and it is known that some species are injured by light in any amount, others seem to thrive best in dim light, while all are injured and killed by an excess, which varies with the species.

The behavior of phyto-plankton then according to the light of climate, latitude and season seems to follow all other forms of

[1] SCIENCE, November 26, 1909.

[2] *Memoirs of the N. Y. Bot. Garden*, Vol. IV., 1908.

protoplasm. Indeed it ought to be safe to predict that the vernal increase in northern waters will continue throughout the summer wherever there is much cloudiness to temper the lethal effects of the midday sun. Perhaps this fully accounts for the wonderful fisheries in northern cloudy, misty, foggy latitudes, rich phyto-plankton serving as food to minute animals, these as food for larger, and so on up to those edible varieties upon which so many millions of people subsist.

It is to be hoped that there will be renewed activity in studying the effects of light on plant protoplasm regardless of its effect on the leaf activities. There is opportunity for valuable deductions applicable to man, for we are finding that the effects of excessive light on unprotected migrant types are much more profound than we formerly believed possible, and there is room for improvement in daily hygiene in the interests of the preservation and eugenic development of these types. The fact that plants depend upon light to enable them to get their carbon food has concealed the fact that it is a lethal agent to naked protoplasm. The medical profession is slowly realizing the dangers of excess, but to place the matter on a sounder and more exact basis, we need more investigations, particularly on plants such as the plankton and the land forms of the lower orders.

The matter is becoming of great economic importance, not only from the fact that life insurance companies are finding less expectancy of life in northern Europe ethnic types too greatly out of adjustment to American climates, but Retzius, in a recent address to the British Anthropological Institute, has called renewed attention to the long-known fact that the northern blond type is unfit for modern industrial life which is being carried on by the brunet races. It has also long been known that the blond types evolved for survival in northern outdoor employments in the cloudy northwest corner of Europe, are so injured by city life, that even as far north as Glasgow, Scotland, they are being rapidly replaced by the brunets, who in some way are better guarded against factors fatal to the others. The disappearance of the blond type, which Retzius predicts, is of course a baseless absurdity. Indeed their numbers are constantly increasing in Europe where they can live, and immigration keeps up the proportion here in spite of their higher death rate. It is possible to lengthen their average life here, if we will only realize what injures them. The premature death of such great men as the late Governor Johnson of Minnesota has a lesson which American anthropologists should heed now that Retzius and Beddoe have led the way. But nothing can be done as long as we consider man so supernatural that he is the only species of living thing whose characters, such as pigmentation, are meaningless freaks of no survival value—an absurd view for which the pre-Darwinian anthropologists are responsible—a view also derived from the old theory that all present-day types are degenerate forms of prehistoric perfect adamites.

So it is of much importance that all vital phenomena in any way related to light intensity should be investigated and explained. The profusion of plankton in northern climates and particularly in the cloudy and foggy places, such as the North Sea and Banks of Newfoundland, is therefore a more interesting and important phenomenon than our biologists seem to realize. In "The Effects of Tropical Light on White Man," published in 1905, I collected all available data then found, but in the succeeding five years much more have been published which show that all racial characters have survival value and some of them are so important as to fit a type for a very limited environment. Pigmentation is of this nature, and so important that its absence is a bar to survival if the type migrates to a very light country. In every known case of survival of the migrated blond race, it is found to be due to the fact that it is in the cloudy mountains such as the Alps, or in northern Italy and Spain, even though it be found by the side of brunets. It is not then such a far cry from the northern richness of phyto-plankton to the existence of large numbers of the sea-faring, Baltic type of man.

Chas. E. Woodruff

ATTENDANCE AT THE GRADUATE SCHOOL OF HARVARD UNIVERSITY

TO THE EDITOR OF SCIENCE: Permit me to call the attention of your readers to a misstatement that appeared in the issue of December 24, 1909, to the effect that the attendance on the graduate school of Harvard University showed a loss as compared with the previous year. The error arose from the fact that in the figures for 1908 the graduate students at Radcliffe were included under Graduate Schools, whereas they were omitted in 1909 under the caption of graduate faculties, but included under women undergraduates. On November 1, 1908, there were 450 students at Radcliffe, of whom 394 were undergraduates and 56 graduates. Adding the latter to the enrollment in the Graduate School of Arts and Sciences gave a total of 460. On November 1, 1909, there were 464 students at Radcliffe, of whom 402 were undergraduates and 62 graduates. Adding the latter to the enrollment in the Graduate School gives a total of 485, representing an increase of 25 over the figures of 1908. This year's attendance on the Graduate School of Arts and Sciences is the largest in the history of the institution.

RUDOLF TOMBO, JR.
COLUMBIA UNIVERSITY

SCIENTIFIC BOOKS

Encyclopédie des Sciences Mathématiques pures et appliquées, publiée sous les auspices des Académies des Sciences de Gottingue, de Leipzig, de Munich et de Vienne, avec la collaboration de nombreux savants. Édition française, rédigée et publiée d'aprés l'édition allemande sous la direction de JULES MOLK. Tome I., volume I., Arithmétique. Paris, Gauthier-Villars; Leipzig, B. G. Teubner. 1904–.

It is customary to await the completion of a work before writing a review of it, but unusual conditions frequently call for unusual action. The greatness of the work before us and its wide range of contact with subjects familiar to all educated people seem to justify a brief review at this stage of its development; especially since such a review may be of service to many who wish to take advantage of the various parts of the work as soon as possible, and since a large amount of work remains to be done before this first volume can be completed, although more than 600 pages of it have been published.

The German work upon which this French edition is based is the work of scholars of many different nations, so that the present work is decidedly international and it is appropriately issued by the two leading mathematical publishers in the world. The object of the German edition is to give as completely as possible the fully established mathematical *results* and to exhibit, by means of careful references, the historical development of mathematical *methods* since the beginning of the nineteenth century. The work is not restricted to the so-called pure mathematics, but it includes applications to mechanics, physics, astronomy, geodesy and the various technical subjects, so as to exhibit *in toto* the position occupied by mathematics in the present state of our civilization.

The French edition aims to retain the essential traits of the German, but it is not merely a translation with the addition of more recent references. On the contrary, it takes account of the French traditions and habits as regards lucid exposition and it treats many subjects very much more extensively than the German edition, while other subjects receive practically the same treatment in the two editions. Both editions are issued in parts—the first parts of the German edition were published in 1898, while those of the French began to appear six years later. The German edition has the advantage of much greater progress towards completion, while the French has a decided advantage as regards exhaustive treatment and more recent references, although these advantages are partly offset by the fact that the additions make the work more voluminous and hence less convenient as a work of reference.

Notwithstanding the fact that the Germans have acted as pioneers in this vast undertaking and have partially prepared the way for the French, yet the latter have had no easy task before them, and in some cases they have done

so much more than their predecessors that the work appears almost new. To what extent this is true as regards the volume before us may be inferred from the number of pages which the French and German editions respectively devote to the various subjects considered in the published parts of this volume. The subjects and numbers of pages in the two editions are as follows, the first number applying to the French edition: Fundamental principles of arithmetic 62, 27; Combinatory analysis and determinants 70, 19; Irrational numbers and convergence of infinite processes with real numbers, 196, 100; Ordinary and higher complex numbers 140, 37; Infinite algorithms with complex numbers 20, 8; Theory of sets 42, 24; Finite discrete groups 85, 19. Hence the total number of pages devoted to arithmetic in the published parts of the French edition is 615, while the German edition devotes only 234 pages in all to this fundamental subject. The article on finite groups is the only one which is avowedly left unfinished in the parts of the French edition already issued, but additions to other articles are also to be made before volume I. is completed.

The list of subjects enumerated in the preceding paragraph constitutes *arithmetic*, the mother queen of mathematics, according to the best mathematical encyclopedia; and this list should be of interest to every educated person as indicative of what are regarded to be the most fundamental mathematical subjects by such an eminent tribunal. As the term arithmetic is now generally employed by mathematicians to include the most basal subjects of pure mathematics, and is not restricted to things which deal directly with numbers, it is of great interest to compare the classifications by eminent authorities and to observe that such new subjects as the theory of sets and the theory of discrete groups of finite order are accorded a place among these basal sciences. It is also of interest to observe that the latter of these subjects is accorded relatively the largest increase of space in this first volume of the French edition as compared with the German. This is partly due to the fact that the literature of this theory has grown very rapidly during the last decade, and partly to the fact that this subject was given a disproportionately small amount of space in the German edition.

It is to be hoped that the present work will have a large circulation in this country, as it will doubtless be a standard for many years. Even those who have only a slight knowledge of the French language will be able to use it to great advantage, as the mathematical notation is practically cosmopolitan. The historical notes and references are especially complete and many of those relating to elementary arithmetic are of interest to teachers of this subject in the secondary schools. It is scarcely necessary to call the attention of the professors of mathematics in our colleges and universities to this work, since most of them have learned to appreciate the German edition and can not fail to appreciate still more an edition offering so many important improvements. While the specialist does not always know everything relating to his subject, it will probably be considered as almost unpardonable if any scholar displays ignorance of what this encyclopedia contains along the line of his chief interest.

Fortunately the volumes are sold separately so that those who may not wish to subscribe for the entire work can procure those volumes in which they may be chiefly interested. The remaining part of volume I. as well as the remaining parts of the other three volumes of Tome I. are, to a large extent, in press and will probably be published within a few years. The second and third of these volumes are devoted respectively to algebra and to the theory of numbers, while the fourth is devoted to the calculus of probability, theory of errors and diverse applications. In addition to the remainder of the article on finite groups, the volume under review is to contain the following: Complements on all the articles in the volume, bibliographical lists of the principal works treated in these articles, lists of the principal technical terms in the four languages, English, French, German and Italian, and the usual subject and author indexes together with a preface and an introduction.

The four parts of this volume which have appeared bear the following dates, respectively: August, 1904, May, 1907, April, 1908, and August, 1909.

The complete encyclopedia is to appear in seven tomes, each consisting of several volumes, probably ranging from three to five. The first three tomes are to be devoted to pure mathematics, while the following three are to treat the applications of mathematics. The seventh and last tome is to be devoted to historic, philosophic and didactic questions. As a large number of eminent French mathematicians are engaged on the preparation of this edition, its completion within a reasonable number of years seems to be assured and the high standard set by the dozen parts which have already appeared, although they are not free from serious errors, promises to be maintained in the future issues. If this is done the work will be indispensable, not only in the larger scientific libraries, but it will also be one of the most frequently consulted works in many private mathematical libraries. Those who do not have easy access to a large library will frequently find in this work sufficient references to guide them safely in their investigations. It is to be hoped that in this way it will serve as a powerful stimulus to mathematical progress in the highest and widest sense.

G. A. MILLER
UNIVERSITY OF ILLINOIS

Crystalline Structure and Chemical Constitution. By A. E. H. TUTTON, D.Sc., M.A. (Oxon.), F.R.S., A.R.C.S. (Lond.), Vice-president of the Mineralogical Society; Member of the Councils of the Chemical Society and of the British Association for the Advancement of Science. Cloth, 6 × 9, pp. viii + 200, figures 54. London, Macmillan and Co., Limited, 1910. $1.50 net.

This interesting volume presents in condensed and connected form the results of a series of investigations in physical crystallography carried out by the author during a period of some twenty years, having for its object the establishment upon the most accurate observational data of the exact relations existing between the chemical constitution and the crystalline form and properties of a series of related compounds.

These investigations consisted of three related parts: namely, the devising of new instruments capable of making more accurate observations than had hitherto been possible in this field; the perfection of methods of preparing crystals for investigation, and the actual measurements of the crystal angles and other constants.

The instruments devised, the description of which occupy chapters V., VI., VII., VIII. and IX., include a *cutting* and *grinding goniometer* so arranged that the small and soft artificial crystals employed could be cut and polished with absolute control of the direction of the artificial surface; the *spectroscopic monochromatic illuminator* to secure for the optical measurements monochromatic light of any desired wave-length; the *interferometer,* an instrument for fine measurements of length by the interference method, employed by Tutton as the essential optical part of the *dilatometer* for measuring the thermal expansion of crystals and of the *elasmometer* for measuring their elasticity by determining the amount of bending which a plate of the crystal undergoes at the center when supported near its ends, under the influence of a weight applied at the center. By means of these highly elaborate instruments the author considers that he has raised the accuracy of goniometric measurements to the level on which atomic weight determinations now stand and the measurements of the physical constants of crystals to the degree of accuracy of wave-length determinations by the interference method.

The materials studied include some 54 salts in two series; the simple anhydrous sulphates and selenates of potassium, rubidium, cæsium, ammonium and thallium, 10 in number; and the double hydrous sulphates and selenates of the above five elements with each of the metals magnesium, zinc, iron, nickel, cobalt, copper, manganese and cadmium, of which 44 were prepared. Many crops of crystals of each salt

were prepared under varying conditions and tested by chemical and spectroscopic methods with utmost refinement as to purity. Not less than 10 crystals of each were measured for crystallographic form and constants and about twelve orientated sections or prisms of each were measured at various temperatures and for six wave-lengths of light in determining the indices of refraction. Determinations of the volume of each salt were also made with great exactness, and the solubility of each in water established. The enormous amount of exacting labor represented by these researches will be abundantly clear to any one who has made such a study of even a single substance.

In chapter X. are presented the results obtained in goniometrical examination of both the normal sulphates and selenates, or orthorhombic series of crystals and of the double sulphates and selenates or monoclinic series.

Chapter XI. treats of the volume relationships of the simple and double sulphates and selenates and the conception of molecular distance ratios or topical axes.

Chapter XII. presents the optical relationships of the two series of sulphates.

Chapter XIII. is devoted to an explanation of the phenomenon of crossed-axial-plane dispersion of the optic axes which is shown to be "due to very low double refraction, combined with close approximation of the intermediate index of refraction to one of the extreme indices; and to the fact that change of wavelength of light or change of temperature, or both, cause the intermediate index to approach still nearer to the extreme one in question until it becomes identical with it, and eventually to pass it, the relative positions of the two thus becoming reversed." The experimental evidence leading to this explanation is beautifully clear.

In chapter XIV. the results of the thermal investigation of the sulphates is presented, and in chapter XV. a summing up of the chief results of the investigations. This summary seems of sufficient interest to justify somewhat extensive quotation, as it appears to be the clearest statement yet given of just what the modern concept of isomorphism involves.

The crystals of the different members of the rhombic series of isomorphous sulphates and selenates of the alkalies,

$$R_2\begin{matrix}S\\Se\end{matrix}O_4,$$

and those also of the monoclinic series of double sulphates and selenates,

$$R_2M\begin{pmatrix}S\\SeO_4\end{pmatrix}_2.6H_2O,$$

while conforming to the same symmetry—that of their particular isomorphous series—and exhibiting the same facial forms inclined at angles which never differ by more than one or two degrees, exhibit progressive variations in their exterior geometrical configurations, interfacial angles and crystallographic elements, in their internal structural properties and constants of which the external form is only the outward symbol, in their optical characters and in their thermal behavior; and these variations follow the order of progression of the atomic weights of the three alkali metals belonging exclusively to the same family group of the periodic classification, potassium, rubidium, cæsium, which by their interchange give rise to the series. The variations are, therefore, functions of the atomic weight of the alkali metal. . . . Similar variations attend the replacement of sulphur by selenium in the acid radicle present in the salts.

The thallium and ammonium salts of the two series exhibit properties fully entitling them to inclusion in these respective series of isomorphous salts, understanding by the term "isomorphous series" a series, the members of which bear a definite chemical analogy, crystallize with like symmetry and develop forms the interfacial angles of which differ only by an amount which has not yet been observed to exceed 2½ degrees. The more exclusive "eutropic series" within each of these isomorphous series, that is to say, the series in which the members exhibit the progression of the whole of the crystal properties according to the atomic weight of the interchangeable chemical elements, comprises solely the salts of the alkali metals K, Rb and Cs which belong strictly to the same family group of the periodic classification, the thallium and ammonium salts being excluded by their essentially different chemical nature and their different crystallographic properties which follow therefrom.

Finally, a third general conclusion is drawn:

Specific chemical substitutions are accompanied by definitely orientated changes of the crystal structure, indicating that particular chemical atoms occupy definitely localized positions in the chemical molecule, and therefore, as the molecule is the structural unit of the space-lattice, in the crystallographic structural unit.

This last principle, first definitely established by these researches, is regarded by the author as the most marked step in advance he has made.

Despite its highly specialized character the book is written in a style that is delightful and should surely be in the possession of every student of physical crystallography.

CHARLES PALACHE

Elements of Mineralogy, Crystallography and Blowpipe Analysis from a Practical Standpoint. By ALFRED J. MOSES, E.M., Ph.D., Professor of Mineralogy, Columbia University, and CHARLES L. PARSONS, B.S., Professor of Chemistry, New Hampshire College. Fourth edition, with 448 pages of text and 583 figures. Cloth, $6 \times 9\frac{1}{2}$. New York, D. Van Nostrand Company. 1909. $2.50 net.

The fourth edition of this well-known textbook differs in no essential matters from the previous edition. The statistics of production of minerals of economic value have been revised, the figures given being those for 1907 and in part 1908. The book gives an excellent presentation of the main facts of mineralogy and deserves to be, as it doubtless is, largely used by teachers of the subject.

It is unfortunate that advantage has not been taken of the opportunity offered by this new edition to improve some of the very poor illustrations that mar certain pages, as well as to eliminate several confusing errors in the crystallographic figures and lettering.

CHARLES PALACHE

Indian Insect Life. A manual of the insects of the plains (Tropical India). By H. MAXWELL-LEFROY, Entomologist, Imperial Department of Agriculture for India, and F. M. HOWLETT, 2d Entomologist, published under the authority of the Government of India, Agricultural Research Institute, Pusa. 4to, pp. 786, plates 84 (many colored), text figures 536. Calcutta and Simla, Thacker, Spink & Co.; W. Thacker & Co., 2 Creed Lane, London. 1909.

This attractive and well-illustrated volume gives, in convenient form, a summary account of the varied insect life of tropical India, in particular. This limitation necessarily precludes the discussion, except in an incidental manner, of the splendid fauna of the Himalayan region. There is much of interest in the work for the professional entomologist, while the amateur will find a large number of the more conspicuous or common insects noticed, accompanied in many instances by facts of great practical value.

The author finds it convenient to treat the varied forms under nine orders, namely, Aptera, Orthoptera, Neuroptera, Hymenoptera, Coleoptera, Lepidoptera, Thysanoptera, Diptera and Rhynchota (Hemiptera) following, in a large degree, the classification adopted by Sharp. The author's aim has been to produce a readable, convenient volume rather than to rigidly follow a classification with possible inconvenience to his readers. The introduction gives some observations upon the principles of classification, the relation of instinct and habit, the sources of information, and a discussion of the zoogeographical divisions of India, the faunal limits of the work thus being plainly defined. At the outset, insects are roughly classified according to food habits, they being divided, for example, into fruit insects, seed-eating insects, flower insects, etc. There is an illuminating chapter on insects and their relations to man, a much more vital topic in the tropics than in the temperate zone.

The space given to the discussion of the orders is necessarily unequal, owing to the fact that representatives of many Indian groups are comparatively unknown. A most attractive feature for the general student is found in the independent chapters or interludes dealing with such topics as: Where Insects Live, Cosmopolitan Insects, Deceptive Coloring, Relative Duration of Life, Insects and Flowers, How Insects Protect Themselves, etc., each of these summarizing from the en-

tire class. The discussion of the various orders or groups is frequently supplemented by brief observations on collecting methods, a most suggestive departure for the amateur. One of the strong features of the work is the extended discussion of the termites, a very important group in tropical countries. The chapter on galls (p. 167) might possibly have been amplified to advantage, since there are a large number of species known to produce deformities in plants. It is doubtful if the author's generalization to the effect that the parent gall insect stimulates the tissues to an abnormal growth, will be sustained by a reexamination of the facts. The paragraphs dealing with the fig insects are of special interest to Americans since the establishment of Blastophaga on the Pacific coast. Another statement open to question is the author's assertion (p. 191) to the effect that there is no real information as to how the two sexes find each other. We are under the impression that some experiments[1] demonstrate beyond all question that certain male insects find their mates through the highly developed, olfactory organs of the antennæ. The observations on the methods employed by Salius (p. 196) in capturing its prey, are particularly commendable. The plugging of rifle barrels with clay, by Sceliphron (p. 207) appears to be a novel record and the same is true of the wasp, *Icaria ferruginea* (p. 215), rendering houses uninhabitable. It is interesting to note that *Xylocopa* on the plains and *Bombus* in the hills, are the dominant flower-visiting insects, the latter being comparable to American conditions. The practicability of using one insect to fight another is strikingly illustrated by the natives employing certain species of true ants to check the depredations of white ants. Similarly, the author mentions the introduction in the Hawaiian Islands, of species of dung beetles, in the hopes that by quickly destroying the droppings of cattle they would abate the plague of horn flies. The chapter on insects as food is exceptionally full and certainly timely, in view of the high price of meat. There seems to be no reason, as observed by the author, why man should "refuse to consider a nice, clean, white termite queen or a dish of locusts" when he includes in his diet shrimps, whelks and even dried sea slugs. A practical suggestion for protecting wood from borers is found in the fact that general experience in India has demonstrated the value of soaking bamboo in water prior to using it for structural work, for the purpose of preventing attack by scolytids. This latter group, despite its importance in temperate regions, receives scant notice.

[1] 1900, Mayer, A. G., *Psyche*, 9: 15–20; 1906, Folsom, J. W., "Entomology," pp. 102–103.

The discussion of the Lepidoptera is relatively full and very satisfactory as a whole, though it is difficult in a work of this character to preserve a satisfactory proportion between the various parts. The large and attractive Bombycidæ, such as *Actias, Antheræa* and *Attacus* come in for their full share of attention. In connection with these forms there is an excellent discussion of the production of silk by insects, together with notes on its composition and a technical description of the four commercial Indian silks. The Microlepidoptera of India appear to be relatively unknown for the most part, judging from the fact that the discussion of the entire series, composed of ten important families, occupies only thirty pages.

The account of the Diptera is very satisfactory as a whole. The Culicidæ, owing to recent discoveries as to the importance of this group, naturally receiving a somewhat extended notice, accompanied by an excellent schematic figure illustrating the life cycle of the malarial parasite. As in some other groups, the author gives a list of the species known to occur in India, following Theobald in this particular instance. It is interesting to note that only two species of Cecidomyiidæ, probably less than one per cent. of the native fauna, are recorded from India. The chapter on Indian blood-sucking insects gives a comprehensive notice of the species addicted to this practise and their economic relations. A considerable number of Rhynchota (Hemiptera) are briefly noticed, though comparatively few Aphididæ and Coccidæ, two groups of great importance in temperate regions, are

discussed. Occasionally there appears to be a slight looseness in wording, as, for example, where the author states that members of the other orders are "deliberately mimicked" (p. 397). Presumably this is hardly what the author intends. We regret the absence of any note upon the value of birds as checks upon insect life. Members of this class rank as most important agents in controlling injurious insects in the temperate regions, and it would seem as though there should be some discussion of the relations existing between them and insect life, even in a work treating of tropical species. The book is completed by a table of contents and an index. We much prefer the general index to separate indices for plants and insects.

This volume with its large series of illustrations, most of them excellent and some surprisingly accurate, must prove of great service to Indian entomologists and of value to others desiring to make comparisons between faunæ of different regions. It is particularly serviceable to the economic entomologist, since the authors have given most of their attention to applied entomology, and many of the colored plates illustrate insect pests. They are to be congratulated upon having prepared a work which will do much to advance the knowledge of Indian entomology.

E. P. FELT

The Fauna of British India. Dermaptera. By MALCOLM BURR, D.Sc., M.A., F.E.S., F.L.S., F.Z.S. Published under the authority of the Secretary of State for India in Council. London, Taylor & Francis. 1910. 8vo, pp. xviii + 217. One colored and nine plain plates. Numerous figures in the text.

The last volume of "The Fauna of British India" to appear from the press is the monographic work upon the Dermaptera of India, Ceylon, and Burma, from the pen of Dr. Malcolm Burr. It is the first volume of the series which has been published under the supervision of Dr. A. E. Shipley, who upon the death of Lieutenant-Colonel C. T. Bingham, the successor of Dr. Blandford, assumed the editorship of this important series of publications.

The Dermaptera, or earwigs, form a compact and well-defined group of insects, which originally were included by Linnæus among the Coleoptera, by De Geer were raised to the rank of an order, and by many later writers have been treated as a family of the Orthoptera. Dr. Burr treats them as a distinct order, and rejecting the amendments of the name suggested by Agassiz and Burmeister, and the half a dozen substitutes proposed by other writers, employs the name originally applied to the group by De Geer and sanctioned by extensive use.

The species of Dermaptera found in the more temperate regions of the world are not numerous, only two occurring in Great Britain, but in the tropics they are much more abundant, and in the volume before us the author enumerates over one hundred and thirty species.

Comparatively very little has hitherto been written upon this interesting order and the bulk of Dr. Burr's work is, as is pointed out by Dr. Shipley, the result of original investigation.

After a brief preface the author gives us a Systematic List of Species. These fall into five families, containing in all fifty-one genera. There are one hundred and thirty-three species definitely allocated and two *incertæ sedis*. The three largest genera are *Diplatys* Serville, *Forficula* Linnæus and *Labia* Leach, containing, respectively, twelve, eleven and eight species. Many of the genera contain but a single species in the faunal region covered by the work.

The next section of the work is styled the introduction, and presents a full and very satisfactory account of the structure, development, habits, and geographical distribution of the Dermaptera. The bulk of the volume is devoted to a detailed description of the various families, subfamilies, genera, and species. There are three appendices, one giving directions for collecting and preserving Dermaptera, the second containing a list of the authors cited, and the third furnishing a glossary

of terms employed. The plates appear to be carefully drawn and are artistically excellent. A careful examination of the book leaves a delightful impression upon the mind. It is in many respects a model of monographic treatment, and the editor, Dr. A. E. Shipley, is quite right in saying that whereas

> Dr. David Sharp in the Fifth Volume of the "Cambridge Natural History" states: "The classification of the earwigs is still in a rudimentary state." . . . Burr's work will cause the deletion of this sentence if a new edition of Dr. Sharp's volume be called for.

The author of the work intimates that he is engaged in preparing upon the same lines an account of the Dermaptera of the entire world. The appearance of such a work will certainly be welcomed, and the present reviewer hopes that the learned author may be spared in health to complete it at no distant day.

W. J. Holland

Carnegie Museum,
March 15, 1910

SPECIAL ARTICLES

CANAL-RAY EFFECTS IN OPEN AIR DISCHARGE

In a paper recently published[1] the writer has shown that the positive luminescence in a Geissler tube is due to a progressive ionization of the air column, and that this ionization begins at the anode wire. In a long tube like that used by J. J. Thomson, this ionization may extend over a distance of fifteen meters.

Since the publication of the paper, evidence has been secured on photographic plates, showing that a disruptive spark discharge in open air can not be produced, until such ionization, originating at the anode terminal, has reached the negative terminal.

Confirmation of this conclusion may be obtained in the manner now to be described. We have used a large eight-plate influence machine.

Small spark-knobs are so adjusted that a torrent of loud sparks passes between them. Hang midway between the knobs a sheet of copper. It is suspended on long silk threads, its plane being at right angles to the line joining the knobs. The sparks can not now be made to pass. A column of positive luminescence joins a positive terminal and a copper plate, but the cathode half of the gap is dark. A glass rod interposed in the positive luminescence casts a shadow on the side turned away from the anode. The shadow is not bounded by right lines, as is the case in rarefied air, where the mean free path is great. When the rod is held near the copper plate, a shadow is, however, cast on the plate. If the plate is moved to a parallel position near the negative terminal, a torrent of sparks passes through the plate. If moved in the opposite direction, until it makes contact with the positive knob, no sparks will pass in any position of the plate. A negative inflow to the edges and corners of the plate is now taking place, as is shown by brush "discharges," but the ionization effects are dispersed in such a way that the conducting channel or channels through the air do not lead to the negative terminal, and no spark can pass unless the spark gap is made shorter.

We have here a clear explanation of the reason why the spark length is greater, when the positive terminal is a small knob than when it is a large one.

A small windmill was placed in the positive luminescence, with its plane of rotation at right angles to the discharge. The vanes were of thin mica sheet. The diameter from tip to tip of the vanes was 8 cm. The vanes were mounted on a hub of hard rubber having a shaft of vulcanized fiber, and turning on pivots of fiber or glass, mounted in hard rubber. The vanes rotated in a direction which showed that the air was drifting away from the positive terminal. As nearly as could be estimated, the rotation was such as was produced by carrying the mill through still air with a velocity of 1.5 meters per second.

All of the results described are produced when the negative terminal is grounded.

These phenomena show that in all probability an X-ray tube will be much less likely to suffer puncture, if its cathode is grounded.

[1] *Trans. Acad. of Sc. of St. Louis*, Vol. XIX., No. 1.

In that case the cathode discharge is (to use a figure of speech) drawn through, rather than forced through the tube. Their bearing on lightning protection may also be of importance.

FRANCIS E. NIPHER

A PRELIMINARY REPORT OF A NEW BLOOD PICTURE

THE fact that the white blood cells and particularly the neutrophiles of the blood react to certain bacilli and certain toxins in such a definite way is of great assistance to the differential blood count either in diagnosis or in prognosis.

Arneth[1] first showed something of this in his papers upon tuberculosis where he showed that while blood of a normal person contains neutrophiles which have nuclei from one to five lobes, that of a tubercular person contains neutrophiles whose nuclei have only one, two or three lobes.

A study of the neutrophiles of normal blood shows that they can be divided into five groups according to the number of the lobes of the nucleus, *i. e.*, Group I., those neutrophiles which contain a single lobed nucleus; Group II., those which contain two lobes and so on up to Group V., which contains those neutrophiles which have five lobes to the nucleus. The number of neutrophiles in these different groups, where one hundred neutrophiles have been counted, forms what may be called the differential neutrophile count, and this is practically constant for all normal blood.

	I.	II.	III.	IV.	V.
100 neutrophiles	5	20	48	22	5

To make this as simple as possible, in order to chart it, a proportion between the two types of neutrophiles can be made as was suggested by Bushnell and Treuholtz,[2] that is, between those neutrophiles which have the fewer lobes, or Group I., Group II. and half of Group III. and those neutrophiles which have more lobes, or Group V., Group IV. and half of Group III.

[1] Arneth, "Die Lungenschwindsucht am Konig Juliuspital," Wurzburg, 1905.

[2] C. E. Bushnell and C. A. Treuholtz, *Medical Record*, March 21, 1908.

Since in normal blood the proportion is usually even, one can thus see at a glance to which side the number of pieces of the nucleus has shifted.

	I.	II.	III.	IV.	V.	
Blood from normal person	5	20	48	22	5	= 49:51
Blood from person with tuberculosis	20	32	40	8	0	= 72:28
Blood from person with infection ..	2	8	40	30	20	= 30:70

The results from my experiments seem to prove that the neutrophile reacts to changes in its environment by some change, probably metabolic, which involves the nucleus and that the state of the nucleus, together with the differential blood count, can be used as a guide as to the condition of the body.

Experiments where guinea pigs were inoculated with tuberculosis bacilli show that the neutrophile first reacts by a rapid increase in the number of lobes of its nucleus and then, later when the guinea pig reaches a state of definite tuberculosis, the neutrophile contains a nucleus of but one, two or three lobes.

Experiments of different sorts show that this same increase of the number of lobes of the nucleus can take place in blood outside the body in such a short time as five or ten minutes.

All the slides I have examined in the opsonic work show this same increase in the number of lobes of the nucleus and I might mention here that it seems a mistake to test certain serum with normal neutrophiles as is done in Wright's opsonic work, since the neutrophiles of the patient may have an entirely different ability to react, from those of the normal person.

Some toxins, especially snake toxin, has the same effect upon the neutrophiles and causes a great increase in the number of lobes of the nucleus.

Observations in the hospital, together with these experiments, seem to prove that the neutrophiles first react to the presence of bacilli or a toxin by some metabolic change, which is shown by increase in the number of lobes of the nucleus; these reacted cells then break down or are used up in the blood followed by

a leucocytosis, which brings in the younger neutrophiles, *i. e.*, with one or two lobes, from the bone marrow. If there is enough toxin or bacilli present, these neutrophiles react even with a leucocytosis and, in all such cases, pus has been shown to be present. As the infection disappears, the neutrophiles cease to react and the number of white blood cells drops until the blood picture is again normal. A good prognosis in such an infection as pneumonia would be a high white blood cell count together with a large proportion of the neutrophiles having the smaller number of lobes to the nucleus, for in this case the neutrophiles which react are being used up and new ones brought into the blood to take their place.

The following are a few typical blood pictures:

Normal

Differential Blood Count		Differential Neutrophile Count	
W. B. C.	8,000	I. 5	
Neutrophiles	65	II. 22	
Large lymphocytes ..	23	III. 48	48:52
Small lymphocytes ..	12	IV. 26	
Eosinophiles	0	V. 5	
Basophiles	0		

Tuberculosis

W. B. C.	10,000	I. 20	
Neutrophiles	64	II. 40	75:25
Large lymphocytes ..	28		
Small lymphocytes ..	6	III. 30	
Eosinophiles	1	IV. 10	
Basophiles	1	V.	

Pneumonia

W. B. C.	20,000	I. 30	
Neutrophiles	80	II. 40	80:20
Large lymphocytes ..	15		
Small lymphocytes ..	5	III. 20	
Eosinophiles	0	IV. 10	
Basophiles	0	V.	

Pus Case

W. B. C.	24,000	I. 4	
Neutrophiles	80	II. 14	
Large lymphocytes ..	12	III. 18	
		IV. 32	27:73
Small lymphocytes ..	6	V. 21	
Eosinophiles	1	VI. 9	
Basophiles	1	VII. 2	

The differential blood count is necessary to determine the different kinds of blood cells present in the blood, but the state of the neutrophile is also of great assistance in making the diagnosis and especially the prognosis.

A paper which gives in detail these experiments, which were carried on in the laboratory of Dr. Max Hartmann, in Berlin, will appear shortly; also the hospital observations made in connection with Dr. James Alexander Miller at the Bellevue Hospital will be reported in a paper with Dr. Miller in May.

Margaret A. Reed

NOTES ON THE FOOD OF A KING EIDER

A female king eider (*Somateria spectabilis*) was captured on Seneca River, N. Y., November 26, 1909, by Mr. J. T. Lloyd. After preserving the bird for the Cornell University Museum (No. 5332), the enteron was opened and examined for its food contents. In view of the scarcity of accurate notes dealing with the food of our wild ducks, the material examined would seem to justify the presentation of the data which follow:

Contents of the crop and stomach

Pisces—1 specimen *Boleosoma nigrum olmstedi*, johnny darter.
Amphibia—2 specimens *Rana pipiens*, leopard frog.
Insecta—3 specimens *Gyrinus*, whirligig-beetle.
Crustacea—67 specimens *Gammarus fasciatus*, fresh-water "shrimp."
Mollusca—1 specimen *Planorbis*, small, 2 mm. in diameter.

Contents of the gizzard

Amphibia—Bones of at least one frog.
Insecta—2 specimens, *Gyrinus*.
2 specimens, *Corisa*, water-boatman.
Crustacea—5 specimens, *Gammarus fasciatus*.
1 specimen, *Asellus*.
Mollusca—3 specimens, *Physa*.
1 specimen, *Limnæa*, small.
1 specimen, *Planorbis*, small, 1 mm. in diameter.
Several pieces of the shell of some large bivalve.
Vegetable—2 small seeds not identifiable.
3 small pieces of the leaves of some aquatic plant.

Mineral matter to the extent of about a dozen grains of sand.

The food in the stomach and crop was very well preserved and it was possible to identify with certainty some of the animals to species —a condition which also obtained rather unexpectedly for a portion of the food in the gizzard, particularly the fresh-water "shrimps." The question arises: How many of these animals were deliberately pursued by the duck? As far as the vertebrates are concerned, there is no doubt but that they were voluntarily taken. The presence of only a small amount of vegetable matter favors a like assumption for all of the invertebrates mentioned, forms which at this time of year occur almost exclusively in the aquatic vegetation. If they were accidentally taken, it would necessarily have been incidental to a large amount of vegetable material.

The beetles and water-boatmen are erratic and rather rapid swimmers and in all probability would have escaped unless deliberately chased by the duck. The disagreeable acrid odor given off by the former evidently did not protect them to any great degree from the bird.

In all of the unbroken molluscan shells the soft parts of the animals were preserved, indicating that the animals were picked off from the vegetation alive.

The surprisingly large number of fresh-water "shrimps," in view of their great ability to conceal themselves under shelter of almost any sort, shows without a doubt that they were voluntarily taken; it also gives a further indication of the importance of this group of crustacea in the economy of water-loving vertebrates.

If our assumption is correct that all of these swiftly moving and self-concealing animals were taken voluntarily, we have an example of a keenness of vision capable of discriminating between food and other substances to a degree not usually ascribed to the flat-billed ducks.

G. C. EMBODY

CORNELL UNIVERSITY

A LARGE SPERM WHALE CAPTURED IN TEXAS WATERS[1]

THE capture on our coasts of a whale of any species is a rare occurrence and worthy of note. The present instance therefore seems to me to deserve some especial attention.

On March 10 of the present year I received a telegram from Port Arthur, Texas, informing me of the capture of a huge sperm whale near Sabine, a small town on the gulf, and offering me every opportunity for making a scientific examination of the prize.

The following day I went down to Port Arthur and found that the animal had suffocated in the mud shallows and had been towed ashore. On my arrival the carcass was on exhibition on a board platform back of one of the docks. Owing to the heat, decomposition had already set in and hence no opportunity was afforded of securing histological material. I availed myself, however, of the opportunity of taking a careful series of measurements, which I here put on record. This seems worth while, since there are few, if any, authentic measurements of large whales to be found in the literature.

	Ft.	In
Total length (air line from tip of snout to extremity of tail flanges)	63	6
Circumference in front of pectoral fins	37	
Width across tail flanges	16	7
Tip of snout to base of pectoral fin	24	6
Tip of snout to angle of mouth	17	1
Dorso-ventral diameter of flat end of snout	10	4
Tip of lower jaw to angle of mouth	10	10

There were 48 teeth in the lower jaw, each of which fitted into a fleshy depression of the upper jaw, which was toothless except for the occasional presence of very small rudimentary tooth-like structures in the bottoms of these depressions.

On the night of March 12 the animal was eviscerated, with the aid of a gang of about twenty negroes and a steam winch, and the abdominal cavity filled with ice. This was dissection on a large scale and afforded a

[1] Contribution from the Zoological Laboratories, University of Texas, No. 104.

unique experience. Nothing of especial note, however, was brought to light.

The whale was evidently an aged "bull" that had been driven from the "herd" by the younger males, had led a "maverick" existence for some time and had strayed far from his native haunts. It is probable that he had met his fate through an ill-advised pursuit of a school of cuttle-fish or squids into a shallow bay, where he became stranded in soft black mud, which soon filled his lungs and literally drowned him.

I have been able to find no previous record of a sperm whale coming ashore on the Gulf of Mexico. If there are other cases I should be glad to learn of them.

H. H. Newman

Austin, Texas

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION G—BOTANY, BOSTON MEETING

As in previous years, Section G held its sessions in alternation with the Botanical Society of America. At Boston a further system of interlocking was made necessary by the program of the newly organized American Phytopathological Society, but it was found by making mutual concessions that conflict of programs could be reduced to a minimum. One joint session was held with the American Phytopathological Society. In the enforced absence of Vice-president Penhallow on account of illness, Dr. B. M. Davis, of Cambridge, was selected vice-president pro tem. The address of the retiring vice-president, Professor H. M. Richards, entitled "On the Nature of Response to Chemical Stimulation," has been published in full in Science. This address was followed by a symposium on botanical gardens, participated in by William Trelease, N. L. Britton, W. F. Ganong, D. S. Johnson and A. F. Blakeslee; it is expected that this symposium will be published in full in Science.

The following officers were chosen:

Vice-president—Professor R. A. Harper.

Member of the Council—Professor A. D. Selby.

Member of the Sectional Committee (five years)—Professor H. M. Richards.

Member of the General Committee—Professor G. F. Atkinson.

Abstracts of the technical papers follow.

Further Observations on the Nature of the Fertile Spike in Ophioglossaceæ: M. A. Chrysler.

The writer's view as to the morphological nature of the fertile spike in Ophioglossaceæ, derived from an anatomical study, receives striking confirmation from certain specimens of *Botrychium obliquum* collected in New Hampshire. These bear either a pair of fertile spikes in place of the normal one, or a pair in addition to the normal one and inserted above it. The vascular supply of the pair of spikes indicates that they represent a pair of fertile leaflets, and the single spike represents a fused basal pair of fertile leaflets. In some cases the two spikes of the pair are fused for part of their length, and in other cases part of the ordinarily sterile segment is fertile. These facts in connection with other considerations lead to the conclusion that the fertile spike of *Botrychium* and *Ophioglossum* represents two fused basal pinnæ of a fern leaf.

Change of Sex in Humulus Lupulus not due to Traumatism: W. W. Stockberger.

The bisexual inflorescence of *Humulus Lupulus* L. was the subject of a brief paper read by the writer before the Botanical Society of America at the Chicago meeting in 1907–8. Since that time some experiments have been performed and data from other sources collected which tend to refute the theory that traumatism is the cause of this abnormality. Removal of the tap root, severe pruning, removal of portions of the crown and cutting back the vines after they had attained a length of four to six feet all failed to cause any change in the normal production of the flowers.

Further, the experiments show that a plant which once produces the abnormal type of inflorescence will continue to do so through successive seasons and will transmit this tendency to its asexual progeny. So far as observation goes, it appears that only plants bearing pistillate flowers are subject to reversal of sex. In an experimental plot of 1,400 seedlings all the plants were apparently normal at first and bore either staminate or pistillate flowers respectively. Later in the summer some of the plants bearing pistillate flowers developed staminate flowers also. Since none of these plants were subjected to the vigorous traumatic treatment described above it is held that some factor other than traumatism produces the sex reversal.

The Taxonomic Value of the Cephalodia in Certain Species of Stereocaulon: Lincoln W. Riddle.

Stereocaulon paschale (L.) Ach. and *S. tomentosum* Fr. have been separated hitherto chiefly by

the amount of tomentum present on the podetia. This, being a variable character, has led to much confusion. It is suggested that the types of cephalodia, being mutually exclusive, may furnish a basis for distinguishing the species. *Stereocaulon paschale* has conspicuous, gray cephalodia containing *Stigonema;* while in *S. tomentosum* they are minute, deep green and with an alga of the *Nostoc* type. In only one case, out of 103 specimens studied, were both types found on the same plant. A statistical study based on the development of tomentum, the position of the apothecia and the type of cephalodia shows that cephalodia are present in about 90 per cent. of the specimens, being more constant in their occurrence than apothecia, and that they are correlated with the development of tomentum to a sufficient degree to warrant their use as a criterion for separating the two species of *Stereocaulon* named. It may be added that *S. alpinum* Laur. has the same type of cephalodia as *S. tomentosum;* while *S. coralloides* Fr. and *S. denudatum* Flke. have the *paschale* type.

Cell and Nuclear Division in Closterium: B. F. LUTMAN.

Closterium, like many of the algæ, is only found in division at night from 10 P.M. to 4 A.M.

The first external sign of division is a pinching in of the chromatophore about two thirds of the way from either tip. No external change is visible in the nucleus at this time. Later, the nucleus apparently disappears and across the middle of the *Closterium*, in the place formerly occupied by it, appears a broad granular band. The cell wall now begins to grow in across the center of this band separating the two halves. In stained whole mounts the two nuclei resulting from division can now be seen making their way back immediately under the plasma membrane to the point where the chromatophore is being pinched in two, in either half. The two halves now break apart, and the new ends are rounded out at first, but rapidly grow and become pointed, making the two halves of the new *Closterium* symmetrical. The entire process takes about four to six hours, as few asymmetrical ones are found at 8 A.M.

The chromosomes are formed from a spireme whose origin is in the fine reticulum around the compound nucleole. There are about thirty to forty of them, slender rods. They arrange themselves on the equatorial plate of a spindle with broad poles, similar to that described for *Spirogyra*. In the reconstruction stages they seem to unite end to end to form a dispireme. They spin out and become fainter and the compound nucleole reappears. There is no evidence that the chromosomes have their origin from the nucleole. The two nuclei move away from each other around the chromatophore, between its ridges, to take their place at the middle of the new halves.

Cell division is by the growth inward of kinoplasmic material which lays down the new wall. The wall cuts across the cell at right angles to the side walls. The central spindle fibers disappear and have nothing to do with its construction.

Corallorhiza and Mycosymbiosis: BENJ. C. GRUENBERG.

Several species of *Corallorhiza* store starch in the rhizome; this is secondary starch, that is, it is derived from organic materials in the soil or humus and is not the direct result of photosynthesis on the part of the plant. Stomata are present in all parts of the epidermis; these are probably active and must be concerned with gas exchanges involved in respiration. The trichomes and epidermis of the rhizome serve for absorption of materials from the soil. It is not necessary to assume that any species of *Corallorhiza* is dependent upon its fungal symbiont for its nutrition. The symbiosis is indeed a constant character of the species examined, but it probably results from the habit of the fungus; it is at any rate not necessary to assume that it is obligatory for the maintenance of the orchid. The fungus may be of assistance to the orchid by furnishing conditions favorable to the germination of the latter's seeds; but it is not improbable that other conditions may also stimulate the seeds to germinate. It is not certain that the fungus is indispensable to the orchid in this connection. The permanent association does not seem necessary for the germination since there are no hyphal connections between the rhizome and the inflorescence. The infection of the rhizome takes place about the time of germination. Hyphæ traversing the trichomes are on their way out; these connections may serve the fungus as means of propagation, but need not be assumed to be of use to the orchid in nutrition. The "digestion" of hyphal masses within the cortical cells may be considered as a means for preventing the spread of the fungus to the point of injuring the orchid; it need not be assumed to be necessary for the nutrition of the orchid. The fungus is probably an internal saprophyte. The mycosymbiosis may have different significance in other families of plants. There is in preparation a "host" index and bibliography of all mycorhizas that have been described.

The Origin of the Primary Bulb in Erythronium: Frederick H. Blodgett.

In the mature seed the embryo of *Erythronium* is a globose mass of cells, without differentiation, slightly pointed toward the micropyle. The seed remains dormant during the summer. The embryo begins to elongate with the coming of the late summer rains. The tip of the cotyledon is early organized as a haustorium, and absorbs the reserve cellulose along the line of elongation. When the embryo has elongated to half the length of the seed the stem apex may be recognized.

The stem apex is located in a narrow transverse slit situated just behind the radicle. By the growth of the cotyledon above the slit, the radicle and the stem apex are forced into the soil. The hypocotyl takes no part in the descent of the stem apex. With the exhaustion of the reserve food of the seed the descent of the stem apex stops. The primary root pushes forward from the end of the descending axis, while the cotyledon frees its tip from the seed coats and reaches upward into the air. One root only is formed by the seedling, and this is unbranched, in our species.

A dropper (primary runner) is formed from the walls of the slit and cells immediately adjacent, and carries the stem apex (primary growing point) forward from the base of the descending axis as the terminal bud in the dropper. The walls of the dropper are equivalent to the first scale leaf of the primary growing point, fused along one side to the stalk of the bud through which vascular connection is maintained with the cotyledon and primary root. The relation of parts is similar to that of the raphe to the rest of the ovule in anatropous ovules.

The primary growing point within the dropper sheath organizes a second scale leaf, the first scale being the dropper sheath.

The second scale leaf encloses the growing point, and these form the bulk of the primary bulb; the sheath of the dropper forms the husk about the bulb. The starch for storage in the growing bulb is obtained through the photosynthetic activity of the cotyledon, acting as the first foliage leaf. The death of the other parts of the seedling leaves the terminal bud of the dropper isolated in the soil as the primary bulb, and marks the end of the first vegetative period of the cycle from seed to flower.

Some New Hybrids and their Bearing on the Classification of Wheat: B. C. Buffum.

The classification of wheat has gone through several changes since the first division by Linnæus into fall and spring species. Hackel recognizes three true species and two subspecies of *Triticum*.

Should some botanists of the present apply their ideas of specific characters to cultivated plants we should have many species of wheat. It is doubtful if any term used in science means less to the thoughtful student than the word species.

My recent work with wheat shows that we may accept the species of Hackel from the old standpoint of their action in cross pollination and yet all have the same origin.

From a single hybridization between a mutating *Triticum sativum* (winter wheat) and a mutating *Triticum dicoccum* (winter emmer), I have secured a complete breaking up of wheats into all the species and types since the beginning of time, and in addition produced infertile hybrids, monstrosities and new types not intermediates. The second generation has given well-defined specimens of *Triticum monococcum*, *T. dicoccum*, *T. spelta*, *T. polonicum* and almost if not quite every well-marked type of *T. sativum*, including various colored bearded and beardless, square head, club and long-headed forms, with every arrangement and shape of glumes and spikelets.

The evidence is conclusive that all wheats have developed from not more than two and probably from a single form.

The question arises should we accept one species or are we justified in using every variation as a specific difference which would divide wheats into many species, and if so, where may the line be drawn?

The Closing Response of Dionæa muscipula Ellis: W. H. Brown and L. W. Sharp.

The closing response of *Dionæa* depends upon the intensity rather than upon the number of stimuli, the number of stimuli required varying in the inverse order of their intensity.

Response is normally brought about by the compression of certain cells at the bases of the sensitive hairs, but the compression of other cells of the blade also causes closure, and it is probable that the latter cells are equally sensitive with those at the bases of the hairs, as is indicated by the effect of electrical and thermal stimulation.

The closing response follows the application of mechanical, electrical or thermal stimulation. It also follows a combination of stimuli of two kinds when consecutively applied, the individual stimuli being of an intensity such that either alone would be insufficient.

The effect of mechanical stimulation is due to a compression of cells, and not to contact with a

hard object, nor to continued pressure, nor to release of pressure. The failure of the leaf to respond to shaking is probably connected with the small inertia of the sensitive hairs, and the slight resistance offered by the air to their passage through it.

Water at room temperature causes closure only when it bends a sensitive hair.

After one mechanical stimulus there is a short period during which a second mechanical stimulus is ineffective.

Effects of Acidity of Culture Media upon Morphology in Species of Penicillium: CHARLES THOM.

Increasing recognition of the economic importance of saprophytic forms, such as species of *Penicillium*, lends interest to the study of their metabolic activities. Although production of certain enzyms determines the ability to digest particular forms of food, the elements necessary to normal growth of any of these forms are present in nearly all kinds of fruit, meat and vegetables, or other food products. The presence or absence of a particular species of *Penicillium* as an agent of fermentation or decay, is therefore determined by its tolerance of other factors. Among these are temperature, relative humidity of the atmosphere, percentage of water in the substrata, the forms of carbohydrate present, the concentration of osmotic substances, and the alkalinity or acidity of the media. One of the easiest of these to demonstrate relates to the alkalinity or acidity of the medium. The cultures shown represent a series of conditions illustrating the range of this tolerance for certain species of *Penicillium*.

Using tubes containing 10 c.c. each of a medium neutral to phenolphthalein, alkali has been added as normal sodium hydroxid, and acid as normal lactic acid. The change in the constitution of the medium can thus be given as cubic centimeters of normal acid or alkali per ten of medium. Uniform volume is maintained by increased concentrations. The range of tolerance in the species studied is from 2 c.c. of alkali per 10 c.c. of medium to 5 c.c. of normal acid to the same amount of medium. Within this extreme range, most species are much more closely restricted. Very few species grow to any degree in plates alkaline to phenolphthalein (*P. brevicaule* and its allies). Of the very common green species but few fruited freely in alkali as strong as a tenth normal. Nearly all grow best between the neutral point and an acidity approximately equal to tenth normal. The most widely reported forms show naturally the greatest tolerance (*P. roqueforti*, *P. expansum*).

The inhibiting effects of acid vary with the species and with the kind of acids. The first effect noted is usually the retardation of growth and especially of the production of colored spores. In some the retardation is temporary; again it reduces the final size of the colony. There results a gradation from the normal colony to very small colonies but with typical morphology. In others, a concentration is soon reached which inhibits the production of colored spores entirely. In others the production of bright colors in the substratum is partly or entirely stopped. The typical morphology of fruiting areas is often greatly changed.

Testing their tolerance to acid emphasizes the close relationship of certain groups of forms and offers a very useful accessory to the description of species. Along with other cultural evidence it seems to show that the presence of special forms as agents of decay in certain fruits (*P. italicum* and *P. digitatum* on citrus fruits), is due not so much to adaptation to the fruit as a form of food as to tolerance of the other substances present. It should be noted that in synthetic media it can be readily shown that the standard formulæ (Raulin's, Cohn's, Uschinsky's, Czapek's) are extremely dilute and in no sense to be regarded as the optimum for mold growth. In fact in solutions of non-toxic substances much greater concentrations may be used than any of these formulæ call for and bring about correspondingly greater masses of typical mold growth. The responses to acidity are much more rapid and radical in the character of the growth obtained, hence quickly reach a diagnostic value in most species.

Effect of Various Gases and Vapors upon Etiolated Seedlings of the Sweet Pea: LEE I. KNIGHT, R. CATLIN ROSE and WILLIAM CROCKER.

The effects of impurities of laboratory air upon the etiolated epicotyls of seedlings of various legumes have been described by a number of German investigators. The effects are three: decrease of rate of growth in length, swelling of the region growing while exposed to the impurity and a horizontal placing of region. These investigators assume that almost any gaseous impurity, even in low concentration, will produce this three-fold response. The accompanying table shows determinations made with eleven gaseous impurities upon the sweet pea, Earl Cromer. The horizontal placement induced by ethylene, illuminating gas and acetylene seems to be an induced diageotropism.

Gas Used.	No. of Parts per Million of Atmospheres to Cause Considerable—		
	Inhibition of Growth.	Swelling.	Horizontal Placing.
Ethylene	.1	.2	.4
Illuminating gas	2.5	5	10
Acetylene	100	250	500
Hydrogen sulfid	500		
Sulfur dioxid	1000		
Carbon disulfid	2000		
Turpentine	2500	5000	
Benzene	4000	8000	
Ethyl ether	10000	40000	
Chloroform	10000	20000	
Benzine	24000	20000	

A New Method of Detecting Traces of Illuminating Gas: Lee I. Knight, R. Catlin Rose and William Crocker.

It has been shown that 12.5 parts of illuminating gas or .5 part of ethylene per million of air will play havoc with flowers of the carnation. Chemical tests will detect no less than 100 parts of illuminating gas per million of air. In a number of cases known to us greenhouse men have been unable to determine, through lack of a delicate test, whether illuminating gas was the cause of serious injuries to their crop. In these cases there was much evidence that gas leaking from imperfect pipes, seeping through the ground up into greenhouses was the cause of the injury. The injuries occurred in cold weather when the ground was frozen and the houses could be little aerated and they ceased with the repair or removal of the defective pipes. We believe from our results reported in the paper above that the etiolated epicotyl of the sweet pea will furnish a delicate and accurate test for traces of illuminating gas.

The Stele of Osmunda cinnamomea: J. H. Faull.

Nodal rays occur in the xylem of seedlings of *Osmunda cinnamomea*, and eventually the edges of one of them close around the intruding parenchyma to form a "stelar" pith. The "extrastelar" pith arises as an eccentric pocket at the inner entrance to a leaf-gap. Its connection with the cortex has been observed in the adult only. Branching is not a seedling character. The seedling stage is long drawn out, and variable. Internal phloem has been found in abnormal unbranched plants.

There is a marked tendency in the Osmundaceæ for the xylem to encroach on the pith. Thus in *Osmunda cinnamomea* one finds internal strands of xylem, closure of the inner ends of medullary rays (in reduced plants to the extent of simulating the cladosiphony of *Osmundites Dunlopi*, etc.), parenchyma pockets in the xylem (characteristic of the family), projections of the internal endodermis in these pockets, etc., all of which indicate a tendency towards "cladosiphony" in the Osmundaceæ, and a possible point of contact with the Gleicheniaceæ.

The facts connected with the stele of *O. cinnamomea* are held to support the theory of the reduction of the osmundaceous stele from an amphiphloic siphonostele.

The Ontogeny of Helvella elastica: W. A. McCubbin.

The fruiting body arises from aggregated masses of the mycelium. It is enclosed at first by a definite velum which early degenerates. Throughout life a layer of club-shaped palisade hyphæ covers the whole surface. Scattered throughout all parts of the interior except in the stem, are large irregular cells serving apparently as storage organs.

The ascogenous hyphæ are differentiated from ordinary hyphal filaments and form a subhymenial layer. These ascogenous hyphæ produce lateral branches from whose 2-nucleate, terminal cells the usual 4-nucleate hooks are formed.

The process from the antepenultimate cell of this hook may, without fusion of its two nuclei, form a second and similar hook, and this series may extend to at least a sixth, the process from the last, after nuclear fusion, becoming the ascus. Thus the two nuclei uniting to form the primary ascus nucleus are separately descended from the two in the terminal cell of the ascogenous hypha.

In any hook of a series the terminal and antepenultimate cells may fuse, their nuclei passing into a process arising from the terminal cell. This process is equivalent to that arising from the penultimate cell and becomes likewise either an ascus or another hook.

An Unusual Walnut: Ira D. Cardiff.

Two instances of peculiar walnuts have come to the attention of the author: one from a tree of northern Indiana and the other from a tree of southern Tennessee. The trees were found to be walnut (*Juglans nigra*) in essentially all but their nut characters. The nut itself, externally at least, is very different in appearance from a walnut. The basal portion resembles very closely a walnut while the apical portion resembles a hickory nut, showing the four furrows that divide the external shell into its four valves. These furrows, however, do not extend entirely through the

endocarp. Laymen have assumed that these nuts are hybrids between the walnut and hickory, *i. e.*, the trees bearing them were true walnuts while the pollen involved in fertilization was from neighboring hickories. In face of known morphological facts this is impossible. The author expects to make a study of this matter from all view points. The purpose of this preliminary statement is chiefly to call attention to these plants and request any one having information of similar ones to kindly report to him at Washburn College, Topeka, Kans.

Studies upon Oxidases: H. HASSELBRING and C. L. ALSBERG.

The study is a by-product of the investigations still in progress of a disease of cabbages and spinach resembling in some respects the mosaic disease of tobacco. As in the latter there seems to be an increase in the oxidizing power of the juice of the diseased areas. By Woods this phenomenon was referred to an increase in oxidase content. To the authors this did not appear to be the only explanation conceivable. It was possible that the oxidase content was only apparently increased, the seeming increase being in reality due to a decrease of anti-oxidase. The anti-oxidases were therefore studied. It was found that egg albumen and blood serum inhibit these plant oxidases and that this inhibition can be prevented if the albumen or serum is first treated with weak acid. It was further found that the addition of coagulable protein to a plant extract varies greatly the ease with which the oxidase is destroyed by heat, probably because of the inclusion of the enzym in the clot. This may account for the fact that plant oxidases are less readily destroyed by heat than animal oxidases, for plant extracts contain as a rule less coagulable protein than those from animal tissues. These observations led to an investigation of oxidase zymogen. Woods made the very remarkable discovery that a plant extract which has lost its oxidizing power as the result of boiling may recover that power on standing some hours. Woods thought that the enzym was destroyed but the more resistent zymogen remained forming fresh enzym subsequently. We found that if a heated extract be centrifugated right after heating, and the clear liquid pipetted off from the coagulum, the clear liquid did not acquire any oxidizing power on standing, while that portion of the liquid containing the coagulum did recover its oxidizing power. It is possible, therefore, that we have to deal not with a zymogen but with the inclusion of the enzym in the clot and its subsequent leaching out on standing.

Some Teratological Features of the Coniferæ: ROBERT BOYD THOMSON.

A new classification of the conifers, the outcome of recent research, has been suggested by the writer. In this the Taxaceæ and the Araucarineæ are associated, the group being characterized by a simple megasporophyll. The Abietineæ, Taxodineæ and Cupressineæ constitute the second group. These exhibit complexity in the structure of the seminiferous scale. Teratological features so far reported are practically confined to the latter, the diplosporophyllous group. These include androgyny, prolification or percrescence of the axis, and modification of the seminiferous scale, the latter often being replaced by a leafy shoot. By many the last of these features, especially, is considered as affording evidence of the brachyblast character of the ovuliferous scale. The writer's observations on numerous hermaphrodite cones of *Pseudotsuga mucronata* confirms and extends this conception. In the aplosporophyllous series, on the other hand, certain teratological features have been found that afford confirmation of the simplicity of the cone scale.

On the Distribution and Origin of Ray Tracheids in Pinus Strobus and P. resinosa: W. P. THOMPSON.

Ray tracheids are characteristic features of certain coniferous woods, notably the pines. A detailed study of their regional distribution in a soft and a hard pine (*P. Strobus* and *P. resinosa*) shows their virtual absence from such primitive places as the stem and root of the seedling, the young branch of the adult and the axis of the seed cone. Their shape and character on first appearance, their mode of development at the cambium, and certain peculiarities of their adult form, demonstrate that they originate from tracheids. These, in the course of specialization, become shortened, radially arranged and intimately associated with the parenchyma cells of the ray. Their extreme specialization is reached in the short buttressed cells of the hard pines.

The knowledge of their distribution and origin in the forms studied supplies a basis for a determination of their general phylogenetic significance.

The following papers were read by title:

On the Organization and Reconstruction of the Somatic Nuclei in Podophyllum peltatum: J. B. OVERTON.

Cleistogamy in the Genus Muhlenbergia: AGNES CHASE.

The Chart Method in Taxonomy: FREDERIC E. CLEMENTS.

Evaporation in its Relation to the Prairie at Lake Okoboji, Iowa: B. SHIMEK.

Alpine Plants and Evaporation: CHARLES H. SHAW.

The following papers represent the contribution of Section G to the joint session with the American Phytopathological Society:

A Spinach Disease caused by Heterosporium variabile: HOWARD S. REED.

Early in 1909 a serious leaf spot was found on spinach in the trucking region about Norfolk, Va. Investigation showed that it was due to *Heterosporium variabile.* This fungus seemed to occur only where other fungi had previously attacked the leaves, and thus confirms views of previous investigators concerning its weak parasitism. The fungus hyphæ when once within the cell spread through the protoplasm in a remarkable manner. The effect of the fungus on the anatomy of the leaf and the process of spore formation have also been studied. Inoculations with pure and mixed cultures confirm previous statements of the parasitism of the fungus.

A New Species of Endomyces: CHARLES E. LEWIS.

The fungus which is described in this paper was discovered while the writer was engaged in a study of fungi associated with apple decay at the Maine Experiment Station. According to its manner of fruiting, this fungus should be classified in the genus *Endomyces* but it does not agree in its characters with any described species.

This fungus grows readily and fruits abundantly on a large number of culture media. The characters by which the fungus is classified have not been changed by growing it on different culture media. The spore sacs, or asci, each containing four spores, have been found in all the cultures, but some media have been found more favorable for their development than others.

The details of spore formation are difficult to make out owing to the small size of the asci and of the nuclei, but they have been studied to some extent.

Three Species of the Type of Æcidium cornutum Pers.: FRANK D. KERN.

The name *Æcidium cornutum* has until recently been made to include practically all of the cornute *Roestelia.* It is now known that in Europe two species have been here confused while in this country there have been three. The identity of these three species has now been worked out and their biology and morphology are discussed in this paper. The original *Æcidium cornutum* Pers. is found to occur only on species of *Sorbus.* The species which has been confused with this in both Europe and America occurs on species of *Aronia.* The third species, which is known only in America, grows on various species of *Amelanchier.* The knowledge of the life-histories of these three species will now permit many references in mycological literature to be straightened out.

Present Status of the Cotton Anthracnose Investigation at the South Carolina Experiment Station: H. W. BARRE.

This paper includes the different phases of investigation as follows:

1. The vitality of the fungus under field conditions as shown by cultures and by germination of spores.

2. The method of infection of the seedlings.

3. The method of infection of the bolls as shown by (*a*) inoculation from pure cultures by puncture, (*b*) inoculation from pure cultures by spraying with spores from pure cultures suspended in sterile water (1) in bloom; (2) bolls in various stages of development.

4. The occurrence of the fungus on the inside of living seeds. (*a*) Method of entrance into the seed. (*b*) location in same; (*c*) production of spores beneath the seed coats; (*d*) development of diseased seedlings from such seed.

A Nectria Fruiting upon the Earth: J. B. POLLOCK.

The life history of the *Nectrias* is of considerable importance both from the point of view of pure science and of plant pathology. The *Nectria* in question was found developing on the surface of earth in which pine seedlings had dropped off with a fungus belonging to the form-genus *Fusarium,* presumably *Fusarium Pini.* It seems probable that the *Nectria* is the so-called perfect form of this species of *Fusarium.* However, this has not yet been proved.

Pine seeds were planted in pots and the soil inoculated with soil from an infected seed bed. Shortly after the seedlings came up they were attacked by a *Fusarium* which agreed essentially with *Fusarium Pini.* Some seedlings survived the attack and the pots were allowed to stand over more than two months in the greenhouse. At the end of that period small and very inconspicuous reddish bodies were observed scattered all over the surface of the soil in the pots. These were peri-

thecia of a *Nectria*. None of them grew upon the dead seedlings but directly on the soil. There was no stroma and no subiculum, though some hyphæ might be found radiating from the perithecia. The experiment was repeated, using infected soil and again the perithecia appeared in a little more than two months. The attempts to grow the ascospores were unsuccessful, perhaps chiefly because of the great numbers of bacteria which developed. Perithecia appeared upon two control pots out of fourteen, as well as upon all fourteen of the infected pots. The control pots stood beside the inoculated pots on the bench in the greenhouse. At the present time the connection between the *Nectria* and *Fusarium Pini* is not absolutely established, but seems very probable.

A Barley Disease: L. H. PAMMEL, CHARLOTTE M. KING and A. L. BAKKE.

During the past season a parasitic fungus made its appearance upon barley, during the early part of July. This new disease manifests itself in the form of brownish circular or somewhat elongated dark-colored spots. The leaves soon become brown. The long cylindrical dark brown spores have from seven to ten divisions and measure 105–130 μ × 15–20 μ. Cultures were made and inoculation experiments demonstrated that the fungus was parasitic upon barley but not upon corn. Hence the disease is different from the *Helminthosporium teres* found on corn and the *H. turcicum*. The spots of *H. graminum* consist of longitudinal striæ of yellowish green color; the spores of this species measure 75–95 μ × 15–17 μ.

Notes on some Diseases of Coniferous Nursery Stock: CARL HARTLEY.

Damping off of coniferous seedlings is commonly caused in this country by *Fusarium*, and favored by moist conditions. In a Nebraska nursery *Rhizoctonia* sp. and a fungus which appears to be *Pythium DeBaryanum*, have been found in diseased seedlings, and inoculations indicate the ability of both to kill germinating pine seeds and to cause damping off. A great deal of damping off occurred under very dry conditions. A parasitic leaf blight on older seedlings was found to be favored by crowding and dry soil, and prevented by the use of shade frames.

Fomes annosus and Two Species of Gymnosporangium on Juniperus virginiana: CARL HARTLEY.

Fomes annosus, a very dangerous root parasite in European coniferous forests, has been reported by Spaulding as parasitic on *Pinus Strobus* and *P. rigida* in New England. It is now found to cause the death of *Juniperus virginiana*, and apparently also of *Pinus tæda*, in Delaware.

Gymnosporangium germinale, and an undescribed *Gymnosporangium* which occurs on bark of all ages, have been found in connection with the gradual death of red cedars in Virginia and Maryland, and by Spaulding in Connecticut. The latter fungus was probably the chief cause of the disease.

Origin of Heterœcism in the Rusts: EDGAR W. OLIVE.

Accepting the view that the heterœcious æcidium cup forms of rusts were the last in evolutionary history and that their ancestral forms were autœcious and similar to the present lepto- and micro-rusts, the paper seeks to contribute toward the question of primary and secondary hosts.

Three arguments are presented toward proof that the present gametophytic, or æcidial, host was the primary host which bore the autœcious ancestor. It is claimed that from a cytological standpoint the main proof is furnished. The stage of the sexual cell fusions is regarded as at least equal in importance to the final stage of teleutospore formation, if not indeed as the most invigorating phase of the whole life history. From a cytological standpoint it seems inconceivable that the jump to an absolutely new host could have been made by the uninucleated basidiospores resulting from the germination of the teleutospores; since the jump would be thus made at a time when the reduction occurs which changes the fungus from the presumably more vigorous diploid generation back to the primitive haploid generation. It seems, rather, more reasonable to expect that the double nucleated æcidiospores, endowed with the greatest amount of vitality from the conjugation which has just preceded them, would be thus much better adapted to make the jump to another distinct host. Reasoning from analogy, we should naturally be led to expect at this stage, following the sexual fusions, new possibilities of development and consequently new possibilities for infection of foreign protoplasm.

Such forms as the morphological species of *Puccinia graminis* are regarded as furnishing another point in favor of this theory. The fewness and evident close relationship of the gametophytic hosts argues strongly that the barberry was the original host in this case and that the vigorous æcidiospores were able in their jump over to a secondary host to infect many sorts of grasses. The third and final point brought out in favor

of the theory is the fact that several species of barberry in various parts of the world act as teleutosporic hosts for several species of rusts, thus suggesting the possibility that at one time the barberry may have acted also as an ancestral host to the teleutospores of *P. graminis*.

HENRY C. COWLES
THE UNIVERSITY OF CHICAGO

THE CENTRAL BRANCH OF THE AMERICAN SOCIETY OF ZOOLOGISTS

THE annual meeting of the American Society of Zoologists, Central Branch, was held at Iowa City, with headquarters at the State University of Iowa, on April 7 to 9. Officers were Edward A. Birge, University of Wisconsin, president; Michael F. Guyer, University of Cincinnati, vice-president; Charles Zeleny, University of Illinois, secretary-treasurer.

The meeting was an unusually successful one, the attendance being large and all but one of the large universities in the territory covered by this branch was represented by one or more zoologists.

There was an informal smoker at the Triangle Club on the evening of April 7, at which President MacLean, of the State University of Iowa, delivered an informal address. Other social features were a lunch held in the Bird Hall of the Museum of Natural History on Friday noon, and the annual dinner of the society at the Burkley Imperial on Friday evening, at which the annual address of the retiring president, Dr. Edward A. Birge, of the University of Wisconsin, was delivered.

The regular proceedings and reading of papers will be noticed later.

The following officers were elected for next meeting: Dr. C. E. McClung, of the University of Kansas, president; Dr. Henry F. Nachtrieb, of the State University of Minnesota, vice-president; Professor Herbert B. Neal, of Galesburg, Illinois, secretary. A committee on nomenclature to cooperate with the Eastern Branch, and ultimately with the International Association of Zoologists, in the revision of rules of nomenclature, was appointed, of which Professor C. C. Nutting, of the State University of Iowa, was chairman; the other members being Dr. H. B. Ward, of Illinois; Dr. S. W. Williston, of Chicago; Dr. C. A. Kofoid, of California, and Dr. C. H. Eigenmann, of Indiana.

The new laboratories of zoology, and the zoological museum were open for inspection and there was much favorable comment on the extent of the equipment, the size, and general style of the new building, and the exhibits in the museum.

SOCIETIES AND ACADEMIES

THE NEW YORK ACADEMY OF SCIENCES
SECTION OF BIOLOGY

AT the regular meeting held at the American Museum on March 14, 1910, Professor Charles B. Davenport presiding, the following papers were read:

Relation between Species and Individual in the Struggle for Existence: Dr. ALEXANDER PETRUNKEVITCH.

From examples taken from the groups of spiders and insects the speaker tried to show that the advantage of the individual is often opposed to the advantage of the species. Structures and habits dangerous to the individual but of use to the species are not uncommon. Their existence proves that the individual is "enslaved" by the species, which condition may be understood only if we consider the individual a mere carrier and protector of the germ. In the evolution of species not the characters of the fittest individual are selected and transmitted to the descendant, but those of the fittest to preserve the progeny.

A Case of Apparent Reversion among Gastropods: Miss ELVIRA WOOD.

The ornament of *Potamidopsis tricarinatum* begins as two continuous spirals, passes through a stage with two rows of nodes and interpolates a third row of nodes in the adult. *Potamidopsis trochleare* has three rows of nodes in the young, later loses the median row and has in the adult two continuous spirals. This suggests reversion in the latter species, but in *P. tricarinatum* the upper spiral disappears before the introduction of the subsutural and median rows of nodes, while in *P. trochleare* the upper continuous spiral of the adult is developed from the subsutural nodes, hence the two spirals of the adult are not equivalent to the two spirals of the young *P. tricarinatum*. *P. trochleare* illustrates progressive development resulting in simplification of structures.

The Preparation of a Museum Anatomical Model: Mr. IGNAZ MATAUSCH.

The speaker gave an account of the successive stages in the construction of an anatomical model of a spider, for museum exhibition. He exhibited a number of dissected specimens of *Lycosa* upon which the model is based, as well as a series of wax models which are made preliminary to casting the final model.

L. HUSSAKOF,
Secretary